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# The Annals

OF THE  
AMERICAN ACADEMY OF  
POLITICAL AND SOCIAL SCIENCE

## GREAT INLAND WATER-WAY PROJECTS IN THE UNITED STATES

*Mississippi Valley Flood Control*

*The St. Lawrence Water-Way from Lakes to Sea*

*Reclamation Dam*

*Great Plains*

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## Basic Factors in Flood Frequency in the Lower Mississippi River

By LEWIS F. THOMAS, PH.D.

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ARE great floods becoming more frequent in the Lower Mississippi River? In terms of volumes of water involved, the answer is no, since the fundamental physical causes of these floods are substantially unchanging. In terms of dollars in losses, the answer is yes, since the economic development of the areas affected is progressively becoming more valuable. The greatness of a flood may be expressed in various ways, (1) by the size of the areas inundated, (2) by the value of the economic losses sustained, (3) by the height of the gage readings, and (4) by the volume of the waters discharged. The records of the United States bureaus show that there have been notable floods in the years, 1815, 1828, 1844, 1849, 1850, 1851, 1858, 1859, 1862, 1865, 1867, 1874, 1882, 1884, 1890, 1893, 1897, 1903, 1912, 1913, 1916, 1922 and 1927. Since 1871 careful and detailed flood records have been kept at all strategic flood points in the Mississippi Basin. Because of the data available, the floods subsequent to 1871 have been studied individually and collectively. The floods prior to 1871 are known only in a general way through the compilation of data from numerous and miscellaneous sources. A resume of the general conditions which exist in the Mississippi Basin gives the setting of flood causation.

### THE MISSISSIPPI RIVER BASIN

The Mississippi Basin comprises some 1,250,900 square miles which are apportioned among its major divisions

as follows: Upper Mississippi River 172,000 or 14 per cent, Missouri River 528,850 or 42 per cent, Ohio River 203,900 or 16 per cent, Arkansas River 186,000 or 15 per cent, Red River 90,000 or 7 per cent, and Lower Mississippi River 70,150 or 6 per cent.

The Upper Mississippi River is about 1200 miles in length. It has as its important tributaries the Leach Lake, Crow Wing, Minnesota, St. Croix, Chippewa, Wisconsin, Rock, Illinois, Iowa, and Des Moines rivers. The headwaters of the rivers which rise in northern Wisconsin, upper Michigan, and northern Minnesota wind in circuitous courses through lakes, swamps, and bogs in the timbered morainic hills of sand and gravel. These features tend to check rapid run-off and as a consequence few floods arise from this region. The prairie portions of the Upper Mississippi Basin are in southern Wisconsin, southern Minnesota, eastern Iowa, and northern Illinois. The once vast tree dotted grasslands are now productive with abundant farm crops, and numerous livestock.

The Missouri River, which is formed by the confluence of the Jefferson, Madison, and Gallatin rivers, in the southwestern part of Montana, flows 2824 miles in a southeasterly direction to join the Mississippi River a few miles above St. Louis, Missouri. Its principal tributaries are the Milk, Marias, Sun, Yellowstone, Grand (South Dakota), Cheyenne, White, Niobrara, Platte, Kansas, Osage, Grand



(Missouri), and Gasconade rivers. The few of the rivers which rise on the eastern slopes of the Rocky Mountains are fed from springs, lakes, and snow fields of that region. The major portion of the Missouri Basin lies in the semi-arid Great Plains. Here the streams are sluggish, turbid, full of shoals and islands, and bordered by easily eroded banks of sand and clay. On the flood plains fields of irrigated crops have replaced the sickly fringe of cottonwoods and willows which once lined the water courses. On the wide gently undulating interstream areas ranching prevails with some dry farming. The tributaries of the lower Missouri Basin drain the western portion of the Corn Belt, or the northern slopes of the Ozarks. The rivers of the Corn Belt section in eastern Nebraska, eastern Kansas, western Iowa, and northern Missouri have numerous tributaries which have carved the uplands into belts of gently rolling hills or flat-topped ridges. The northern slopes of the Ozarks are maturely dissected hills whose steep rocky sides favor swift streams, rapid run-off and sudden floods. The basin of the Gasconade River is typical.

The length of the Ohio River from Pittsburg, Pennsylvania, to Cairo, Illinois, is 965 miles. The headwaters, the Allegheny and Monongahela rivers, together with the tributaries Licking, Muskingum, Little Kanawha, Great Kanawha, Big Sandy, Kentucky, Cumberland, and Tennessee rivers drain the wooded rugged, rocky hills of the Appalachian Plateaus. The clearing of some of the forests together with the steepness and completeness of surface drainage provide conditions favorable for sudden rises in these rivers in periods of heavy rains. Other important tributaries to the Ohio River are the Scioto, Miami, and Wabash rivers. These rivers in western Ohio, Indiana,

and eastern Illinois (the eastern Corn Belt) are similar to those in the western Corn Belt.

The Arkansas River rises in central Colorado, in the Rocky Mountains. After passing through the Royal Gorge, it emerges on the Great Plains; crosses eastern Colorado, southern Kansas, northeastern Oklahoma, and central Arkansas; and empties into the Mississippi River in southeastern Arkansas. In its 1610 miles, it resembles the Missouri River features. Its headwaters are clear on a bed of pebbles and rock. In the Great Plains section, the Cimarron and Canadian tributaries add their contribution of mud and quick sand to that of the Arkansas. The lower Arkansas flows through a region rich in agriculture of the plantation type where cotton and rice predominate. The most volume is added by the White River which rises in the rugged hills of the Ozarks and Boston Mountains.

The Red River is about 800 miles in length from its sources in west Texas to the Lower Mississippi in Louisiana. Its flow through much of its course is scanty and precarious, since it is dependent solely upon immediate run off from rains. In its lower course it fares better in a region of more abundant and regular rainfall.

The Lower Mississippi River extends from the mouth of the Missouri River to the passes at the Gulf of Mexico. About half of the basin is alluvial floodplain type comprising some 30,000 square miles. These plains are about 600 miles in length, but the river meanders through a course exceeding 1100 miles. The surface has a very low gradient which combined with the oxbow lakes, sloughs, and bayous, and with the timbered sections favors very slow run-off of precipitation. Prior to the building of levees and the organization of drainage districts much of the

basin was subject to inundations and as a consequence lay idle. Since these projects have been completed large sections are cultivated and devoted to cotton growing. It is this basin that suffers most from floods in the Mississippi River system.

#### OCCURRENCE OF SEVERE FLOODS

The comparative severity of floods is usually determined by levels reached by the various floods on the same gage. By way of illustration, the gage at the mouth of White River, Arkansas, may be selected as typical of readings along the Lower Mississippi River. The gage is located 391.7 miles below Cairo, Illinois, and has its zero at 108.86 feet above mean Gulf level. The highest annual minimum is 14.20 feet, while the majority of such readings are below 7.00 feet. The flood stage at this station is 48.00 feet. The years when floods attained or exceeded this mark are: 1862, 48.20; 1882, 48.40; 1883, 48.00; 1886, 48.20; 1890, 50.40; 1892, 49.27; 1893, 49.48; 1897, 52.42; 1898, 51.05; 1899, 48.49; 1903, 53.70; 1904, 49.50; 1906, 49.80; 1907, 51.90; 1908, 49.50; 1909, 49.95; 1911, 48.33; 1912, 56.35; 1913, 55.35; 1916, 56.50; 1917, 51.57; 1919, 49.38; 1920, 53.10; 1922, 56.85; and 1927, 60.25. It is quite apparent that there is a tendency toward higher and higher readings culminating in the record breaking flood of 1927. An examination of other Lower Mississippi River stations reveals similar trends.

Further survey of the flood data shows that stations on the major tributaries have their record maximum in different years, and that even on the same tributary stations may have had the records set in different years. On the Upper Mississippi River, these gages recorded their maximum as indicated; St. Paul, Minnesota, 1881; Winona, Minnesota, 1880; Rock Island,

Illinois, 1892; Burlington, Iowa, 1851; Nashville, Iowa, 1888; Hannibal, Missouri, 1903; St. Louis, Missouri, 1844. On the Missouri River, the record maximum was made at Kansas City, Missouri, in 1844, and at St. Charles, Missouri, in the same year. On the Ohio River, the records were broken at Pittsburg, Pennsylvania, 1907; at Cincinnati, Ohio, 1884; at Louisville, Kentucky, 1884; at Evansville, Indiana, 1844; at Paducah, Kentucky, 1913; and at Cairo, Illinois, 1927. On the Red River at Shreveport, Louisiana, and on the Arkansas River at Little Rock records were set in 1927.

The area of the overflowed land has varied during the various great floods due to the holding, extension or breaking of the levees. Before 1880 the Lower Mississippi River had practically free, open, and unrestricted channel conditions, so that the areas flooded by severe floods were about the same each time: 29,790 square miles. Beginning in 1880, there has been progressive extension, raising, and strengthening of levees. By 1916 the river was practically canalized from Cairo to the Gulf. The effects of this levee building have been more pronounced than the figures indicate, because the flood marks at stations below Cairo, Illinois, have been changed to meet the new conditions several times since 1896.

Contemporaneous with the building of levees has occurred a general shrinkage in the area flooded as is indicated: 1897, 13,580; 1903, 6,820; 1912, 17,605; 1922, 13,200; and in 1927 when the levee system collapsed, estimated 15,000 to 18,000 square miles. The losses may be classified as, (1) property losses exclusive of crops, (2) crop loss and damage, (3) damage to farm lands, and (4) losses occasioned through enforced suspension of business. The estimated losses for 1897 were \$15,000,000 for agricultural damage. In

1903 a total of \$40,000,000; in 1912, \$78,000,000; in 1922, \$17,087,790; and in 1927 about \$285,000,000 in losses. Such losses even though they be rough estimates cause one to ask: How often must these losses be borne?

#### FREQUENCY OF SEVERE FLOODS

Attempts have been made to reduce the question of flood frequency to a mathematical basis. One set of calculations has been prepared for the Lower Mississippi River. Selecting New Orleans as typical it is illustrated by the number of ordinary floods per decade from 1871 to 1922, thus: 7, 10, 9, 6, 7, total 39. The frequency for severe floods at the same place and period is: 1, 1, 3, 3, 5, total 13. Vicksburg, Mississippi, and Memphis, Tennessee, show similar series. The expectancy or average interval in years between ordinary floods has been computed as 1.33 at New Orleans, 1.30 at Vicksburg, and 1.37 at Memphis. The similar expectancy for severe floods at the same places is respectively, 4.00, 3.06, and 5.20. The lack of correlation which is noticeable between the ordinary and severe floods is due to the fact that ordinary floods may be and frequently are caused by high waters in a single tributary, particularly the Ohio River, while severe floods are usually the result of high waters in two or more tributaries. The fact that the tributaries do not have high waters at the same time, except rarely, was shown by the data above for the years breaking records.

The flood frequencies of the major tributaries further show the lack of coincidence of high waters. This is shown for ordinary and severe floods (latter marked \*) as follows: the Ohio River at Cairo, 1.33 and \*2.08; the Upper Mississippi River at St. Louis, 2.74 and \*10.40; the Arkansas River at Little Rock, 1.41 and \*5.78; and the

Red River at Alexandria, 3.80 and \*38.00. Thus it is evident that the chances of high waters occurring at the same time on all the major tributaries is rare. The last flood, 1927, was the nearest approach. Moreover it appears that there is a close relation between the floods of the Ohio and the Lower Mississippi rivers.

#### CAUSES OF FLOODS

Students of the floods assert that the Ohio River is by itself capable of producing severe floods in the Lower Mississippi River. And so another set of calculations has been made to determine the frequency of floods in the Ohio River. It appears from a study which correlates precipitation data and flood occurrence data in this basin that there is no evidence of increasing frequency of floods. It does demonstrate that there is a cause and effect relation between the precipitation features and floods. Thus, there was a rainfall deficiency in the Ohio Basin during the decade 1870-1880 which would account for the lack of floods of any noticeable size in that period. In 1881 to 1883 there was a large excess in rainfall which accounts for the great floods of those years, culminating in the record gage reading of 71.07 in 1884. Then followed a period of deficiency with no floods. In 1890 there was a local excess in the lower Ohio Basin which tallies with the flood in that part of the valley. Then drought followed, and no floods resulted until 1897; then a couple of years of heavy rains with corresponding floods; a term of dry years to 1906, then rains and floods in 1907. Similar studies concerning the Upper Mississippi River and lower Missouri River show conclusively that precipitation conditions are competent to produce the floods, and that the floods are as irregular in occurrence as precipitation conditions are fickle. Hence a review

of the general conditions in the Mississippi Basin with regard to precipitation will aid in understanding the factors of flood frequency.

Normally there is scanty precipitation over the western and northern portions of the Mississippi Basin in January, February and March. At the same time rainy conditions prevail over the southern Appalachians. During April and May precipitation reaches its greatest amount over the West. In June two rainy centers appear: one in the Lower Mississippi, and the other in the lower Missouri basins. In July and August, rainfall diminishes in the West and becomes uniform over the Lower Mississippi Valley. September, October, November and December successively approach winter conditions with light precipitation over the West, and intense heavy downpours over the lower valley in December. The character of the ground, whether frozen or water soaked, has a great deal to do with the percentage of run-off from these precipitation conditions.

It has been estimated that about twenty-seven per cent of the precipitation in the Upper Mississippi Basin finds its way to the rivers and amounts to about 230,130,000,000 cubic yards of water. The early summer rains and winter scantiness result in a single swell reaching its height in June and declining to August, with marked low water levels to late January when the swell begins again.

In the Missouri Basin about fifteen per cent of the rainfall reaches the rivers and gives a normal discharge of about 131,230,000,000 cubic yards of water. The Missouri minimum occurs in December and rises to a minor swell in May which is followed by a major swell in June, after which the river level falls rapidly to a December minimum.

The Ohio Basin receives the most abundant and well distributed precipi-

tation of all the component basins. This with its thirty per cent run-off totals about 230,130,000,000 cubic yards of water which makes it rank first in volume among the tributaries. The Ohio River normally because of winter rains in the Appalachians, has high water in March. Its low stages come in October.

The Mississippi River regimen below Cairo is the composite of the combined swells of its tributaries. The main swell of the Ohio River reaches Cairo about the middle of April, having risen rapidly. The ebbing of the swell is checked by the rising swells from the Upper Mississippi and Missouri rivers. Hence the swell below Cairo consists of one long sweeping rise for six months and one long decline of similar length. The heavy rains over the Lower Mississippi Basin at times aggravate the normally high waters into flood conditions.

The Arkansas River discharges about fifteen per cent of its precipitation amounting to about 74,070,000,000 cubic yards of water. The Arkansas River is low in August and high in May. Its swell normally has no effect upon the regimen of the Mississippi River.

The Red River with its annual discharge of 66,670,000,000 cubic yards of water, representing about twenty-two per cent of its rainfall, has a range similar to the Arkansas with similar lack of normal effects.

It may be noted again that the timing of these various swells from the major tributaries, considered from the standpoint also of their geographic location, gives a rhythmical succession of increments which normally results in harmless high waters. However, normal conditions do not always persist. In every case the floods can be traced to excess discharges from some one or more basins.

The actual discharges of water in a few of the great floods 1882, 1903, 1912,



1913, 1915-16, 1920 and 1922 according to calculation each exceeded 159,000,000,000 cubic yards. For example, the flood of 1882 was made up as follows: Ohio River, 107,868; Upper Mississippi River, 30,693; Lower Mississippi River, 68,005; Missouri River 25,826; and Red River 24,874 making a grand total of 272,137 in millions of cubic yards of water. This flood which is rated as an exceptionally severe one is typical of the kind produced by a great discharge from the Ohio River basin. The flood occurred early in 1882. During the months of January, February and March when the above discharges occurred, there was an excess precipitation over the southern half of the Ohio Basin and Lower Mississippi Basin, and over the lower Arkansas and Red basins ranging from 8 to 12 inches excess.

In 1927 all the rivers south of the Des Moines River were in excess discharge, with excesses ranging from six to nine inches in Iowa to twenty-three inches in the middle Arkansas Valley. The nearest approach to such conditions in the recorded past occurred in 1922 when there were excesses over the lower Ohio and Mississippi basins in February, with a spreading of excess conditions to the northward over the lower Missouri and lower Upper Mississippi basins by March. The total discharge of this 1922 flood is estimated at 265,146,000,000 cubic yards of water. The evenness of the distribution of excess is shown as follows: Ohio

River, 81,115; Upper Mississippi, 31,410; Lower Mississippi, 52,658; Missouri, 39,589; Arkansas, 31,410; and Red, 27,962 millions of cubic yards of water.

The flood discharges for the other floods listed (in millions of cubic yards) are: 1882, 272,137; 1903, 200,786; 1912, 239,774; 1913, 228,759; 1915-16, 170,049; 1920, 159,196; 1922, 365,146. These figures give some notion of the immense volumes of water which pass down the Mississippi River at flood times. As a measuring stick, the normal river flow past St. Louis, Missouri, is estimated at 225,000 cubic feet per second. It is stated by observers at Little Rock, Arkansas, that the Arkansas River ran at 813,000 cubic feet per second during the 1927 flood.

#### CONCLUSIONS

It may be concluded:

I. That the basic factors of severe floods causation are uncontrollable.

II. That the frequency of severe flood occurrence is a function of precipitation and varies irregularly as the amount and distribution of precipitation varies.

III. That the engineering problem is to regulate the flow of flood waters and prevent the inundation of valuable lands.

IV. Supplementary, that such engineering works should be designed to conserve the features of the rivers adapted to waterpower, navigation, water supply, and sanitation.



# The Geography of the Mississippi Valley

By FRANK E. WILLIAMS

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WHEN Daniel Boone returned from one of his hunting and exploring expeditions, he was more than usually extravagant in his praises of the area he had just visited—that reached by passing westward through the famous Cumberland Gap. Here was a land described as rich in growth of all those hardwoods which show unusual fertility in the soil. The region he had seen was a part of the now well-known Blue Grass Region—a basin rich in agricultural development. But the Blue Grass Region, although one of the richest, is only a speck in that larger area of high fertility and gentle topography which reaches from the Alleghanies to the Rockies and is for the most part contained in the Mississippi Valley.

The Great Mississippi River and more than fifty navigable tributaries furnish about 14,000 miles of waterways and border or traverse twenty-seven states whose combined area is 1,935,952 square miles (65 per cent of U. S.). Of these twenty-seven states, seventeen are entirely or very largely within the Mississippi Drainage System. The importance of this great inland empire is unappreciated by most, only partly recognized by a considerable number and fully known to but few. Here is one of the best farming regions of the world, and when it was opened to the growth of the cereals New England and much of other Eastern areas went "down and out." In this area of the Mississippi Valley a little over half of the people of the United States live. Here is 65 per cent of the improved land of the nation.

Here is produced about 85 per cent of the country's crop of corn, 65 per cent of the wheat, 78 per cent of the oats, and almost 50 per cent of the cotton. Here also are raised about 65 per cent of the horses, 60 per cent of the dairy cattle, while 55 per cent of the beef cattle, 80 per cent of the hogs and 45 per cent of the sheep of the nation are made ready for the market. Here are obtained about 75 per cent of our bituminous coal, a considerable portion of the iron ore, over 50 per cent of the lead and over 50 per cent of the zinc. This area is also growing rapidly in manufactures and if the lake cities are included now produces almost 50 per cent of the country's manufactured articles.

## TOPOGRAPHIC FEATURES

Most of this great area which is so rich in resources is without striking topographic features. It is generally level or gently rolling, occasionally hilly, but never mountainous. Much of it appears as a limitless expanse of grove-dotted, gently undulating country, here and there trenched by rivers and surmounted by low hills; or it stretches away as far as the eye can see without either of these relief features—a grass-covered, farm-dotted, smoothly contoured prairie. North of the Missouri and Ohio Rivers it is glaciated. Morainic belts cross it in looped pattern, and between them are notably flat till plains. In that portion covered by glacial ice in the last (Wisconsin) glacial invasion, lakes, ponds, and undrained hollows in great numbers are scattered freely about, stream courses

are disorganized, falls and rapids abound and alternate with swampy depressions often of considerable extent. Most of the area, however, is well drained and well fitted for agriculture. This is shown by the great number of evenly spaced comfortable houses and big barns.

From north to south almost through the center of this area flows the mighty Father of Waters. This great stream, although at times a devastating curse to many inhabitants of the valley, has been of great importance in opening up the country to settlement and has borne many millions of tons of produce to market.

This great valley and its river system present a twofold problem. It has low-water difficulty as well as a high-water peril; it involves keeping navigable depths in the channel as well as keeping navigation off the riparian corn and cotton fields; it associates intimately the interests of navigation and conservation. It is, then, the problem of keeping the system in shape to carry river commerce and of controlling its disastrous floods.

#### RIVER COMMERCE

Although the lower river is still important as a commercial highway its value to the people of the valley was much greater in the past. New Orleans was established in 1718, but for a decade before this the river had been used as a carrier for furs and for lead from the easily worked mines along the river in Iowa and Wisconsin. By 1740 there were about 2000 farmers along the river in Illinois whose only outlet for their produce was the river. It is true that the early Western settlers could send over the mountain to the Eastern markets the valuable articles of little bulk, such as furs, ginseng or whiskey, or the livestock which could be driven to market. For carrying

their flour, pork, tallow, leather and lumber to market they used keel boats and barges.

The steamboat made its appearance on the Ohio River in 1811 and by 1817 had been improved so that it could cope with the currents of the Mississippi and other interior rivers. With further improvements, the steamboat became important by 1822 and river traffic developed rapidly up to 1846 when the output of the lead mines began to decrease. The lead was beginning to go east via the Great Lakes and Erie Canal because the cost was less. The river boats had been having great difficulty especially at the rapids at Rock Island and at Keokuk, which at low-water stages in summer and fall were almost impassable and which often necessitated the reloading of cargoes into barges of light draft which were towed over the rapids with horses.

From 1840 to 1855, in spite of the difficulties of the rapids, etc., the boats reaped a rich harvest because of the large numbers of settlers going into Iowa, Wisconsin, and Minnesota.

The period 1858-1870 is the period of railroad competition, at first helping river commerce, later destroying it.

This period also saw the development of a new type of carrier, the grain barge, towed by steamboats. These were extensively used for about ten years, but about 1870 the railroads had penetrated the grain growing section, and the grain barges soon became almost useless.

Fifty years ago there were 470 steamboats plying regularly on the Mississippi. At the present time, you would have a hard time finding forty-seven, even if you were to count a few government snag and dredge boats to make up the total. In the spring a few big coal tows descend the stepping stones of the Ohio from Pittsburgh to Cairo, and then on down the main

river to the gulf. Near Vicksburg, Memphis and Baton Rouge, a few steamboats come and go on local routes over the waters. Now and then a lone towboat shoving a barge ahead of it disturbs the desolation of the Missouri (once the only artery to the West), and occasionally dwellers near the banks of the Arkansas or Red Rivers hear the whistle of a laboring stern wheeler as she paints their blue skies with a black smoke. River commerce of the present time is of relatively slight importance and along much of the river is largely confined to excursion steamers and sand barges. In fact, the channel is such that after August 1, a boat of six feet draft has great difficulty getting up to St. Louis on the lower river and a boat drawing but four feet of water can only with great difficulty get to St. Paul.

#### REASONS FOR DECLINE OF RIVER TRANSPORTATION

Two generations ago the Mississippi and its main tributaries were alive with water traffic. Now there is almost none. What are the reasons for this decline? There are several. The Civil War blockade of the lower river by the Confederacy, temporarily stopped down river traffic and helped the railroads in their lead over the river boats, a lead which was not reversed after the war because most of the trade in this section naturally moves east and west, not north and south, and when once started in its natural direction, if even by a temporary cause, is not easily changed. At the close of the Civil War, cheap slave labor to man the boats and load and unload them disappeared. Discriminatory rates by the railroads were also a factor, but the outstanding cause for the decline of the river traffic is that the steamboats could not compete with the new carrier, the railroad, not only in freight costs but also in several other ways. River

traffic is limited to a certain natural route. Railroads can be built anywhere. There is no closed season for railroads and their traffic is regular throughout the year, while the farmer who attempted to ship by boat could not tell when to have his stock or produce at the river bank and the yards and storage facilities at the landings were either not there at all or very unsatisfactory. Another factor which was important in causing trade to leave the boats and go to the railroads was the variability of the boat freight rates. In one case the rate during high water was 25 cents per 100 pounds and the low water rate was \$2.50 for the same distance.

Also, the difficulties of maintaining a channel are great. There were recently 43 sand bars below Cairo, each with an average length of about 800 feet. At low river stages these come up to within four or five feet of the surface. On the tops of them lie dead trees, anchored by their matted, up-torn roots. These are the bars and the snags, which obstruct navigation at low water. Because of them, big fleets of government snag boats and dredges are maintained. There are 18 high bridges and 25 drawbridges between St. Paul and the mouth of the Missouri River, which also hinder navigation. From New Orleans 110 miles down to the Eads Jettie at South Pass, the river is 100 feet deep, and for 300 miles up river from New Orleans there is sufficient depth for navigation at low water, but the remaining 600 miles to St. Louis requires constant dredging to maintain even an eight-foot channel such as has been done for several years. The 180 miles from Cairo up to St. Louis is one of the worst sections of all.

#### DESCRIPTION OF THE MISSISSIPPI

We have briefly discussed the use of the river, let us now see what it is

like. The source of the Upper Mississippi is in north central Minnesota in a region which is sprinkled with a multitude of small lakes, and is close to a slight swell of land which separates it from the waters of the Hudson Bay. These lakes lie in a wilderness of evergreen woods and tamarack marshes, of low-lying hills and ridges left by the northward retreating glacier. From a physiographic point of view, the river flows through a valley representing three types of formation. From its source to Minneapolis, the river flows through a shallow or "young" valley. Leaving the small Lake Hernando de Soto through an almost indiscernible outlet, its waters flow through alternate lakes and marshes and over many rapids and falls until it plunges over St. Anthony into the gorge below. In this course of the river, many artificial dams have been built, thus adding to the storage capacity of the natural reservoirs.

Below Minneapolis is found the second part, which extends down the river 888 miles of its course to Cairo, Illinois. For this part of its length, the river flows in a gorge varying from one to six and a half miles in width and with bluffs rising from 100 to 650 feet above the river. These bluffs are not continuous like the Palisades of the Hudson or like the Niagara River Gorge, but stretch along the river on either side "like lines of giant sentinels." This is the part of the river noted for its beauty — "majestic bluffs that overlook the river, along through this region, charm one with the grace and variety of their forms, and the soft beauty of their adornment. The steep, verdant slope, whose base is at the water's edge, is topped by a lofty rampart of broken turreted rocks, which are exquisitely rich and mellow in color — mainly dark browns and

dull greens, but splashed with other tints."<sup>1</sup>

Below Cairo, the valley is a level flood plain 50-100 miles wide, with much of this area below water level of the river at high stages. Beginning as it does but 1500 feet above sea level, in the 2555 miles of descent to the Gulf, the river can average a fall of less than six inches per mile. It makes more than half of this descent in the 600 miles from its source to St. Paul, and for the rest of its journey (1950 miles) it falls only three or four inches per mile. With a low gradient goes a low average velocity; nevertheless, the Mississippi River carries down and empties into the Gulf of Mexico every year about 400 millions of tons of mud. To transport this mud by rail would require 500 trains of 50 cars each hauling 50 tons per car, working every day in the year. Thirty-one per cent of the water of the Lower Mississippi is contributed by the Ohio River, 19 per cent by the Upper Mississippi and only 14 per cent by the Missouri, but with the 14 per cent of water of the latter, comes 60 per cent of this silt. The Mississippi River, a few miles above St. Louis at the mouth of the Missouri River, is one and one half miles wide, but from this junction to the mouth of the Ohio, it narrows to about three-quarters of a mile in width. This great tributary seems to diminish the width of the main stream, but as perceptibly increases its depth and volume and alters its character.

#### DIFFICULTIES OF DOCKING AND NAVIGATION

The Mississippi River, then, is very different from one of the type represented by the Delaware or Hudson. Instead of tides of from five to eight

<sup>1</sup>Twain, Mark, "Life on the Mississippi." Harper & Bros.

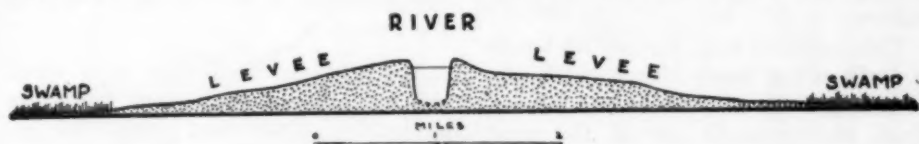


feet which do not seriously interfere with docking or navigation, on the Mississippi River we have stages varying through a range of 54 feet between high and low water at Cairo, Illinois, and almost as much at many other cities. At a point about a mile below this city in the extreme southern point of Illinois, the Ohio, normally about a mile wide, and the Upper Mississippi, half a mile wide, flow together. The river, especially from this junction down, which is really the trunk line portion of the system, is made up of a series of wide curves, and loops which are called oxbows. When the narrow strip of land, between the upstream and downstream sides, of one of these loops is washed away, the river takes a short cut and leaves a crescent shaped lagoon or bayou. "These cut-offs have had curious effects: they have thrown several river towns out into the rural districts, and built up sand bars and forest in front of them. The town of Delta used to be three miles below Vicksburg; a recent cut-off has radically changed the position and Delta is now two miles above Vicksburg."<sup>2</sup> In another part of his book, Mark Twain states that, "In the space of one hundred and seventy-six years, the Lower Mississippi has shortened itself two hundred and forty-two miles." Using this as a basis of

<sup>2</sup>Twain, Mark, "Life on the Mississippi." Harper & Bros.

computation, he rather facetiously writes: "Any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three-quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and a mutual board of aldermen." So crooked is the river's course that, although the channel distance from Cairo to the Gulf is 1200 miles, the air line distance is only half as far. Instead of rock as is found along the banks of a river like the Delaware or Hudson which affords good foundations for factories and wharves, the Mississippi's banks, especially along the lower part of its course, are fine sand, silt or gravel, which almost dissolves when it gets wet. From St. Louis to Cairo, bed rock (within the gorge) averages 50-150 feet below water level, while below Cairo it is much deeper down. There are, therefore, almost no factory sites on the water front on the Lower Mississippi and wharves are hard to build and maintain. The discharge of a river like the Delaware or Hudson remains relatively constant through the year, while that of the Mississippi River varies from about 70,000 cubic feet per second at low water to 2,300,000 at high water stages.

We must keep in mind that the material upon which the river is flow-



PROFILE OF THE MISSISSIPPI RIVER AT BELLE POINT

ABOUT 50 MILES ABOVE NEW ORLEANS. SHOWS  
NATURAL LEVEES AND HOW WATER WOULD POUR  
OUT INTO SWAMPS ACROSS THE OCCUPIED AREAS  
ON THE LEVEE SLOPES IF A BREAK SHOULD OCCUR.  
(VERTICAL SCALE EXAGGERATED)



ing was carried there by itself or its tributaries. Sediments brought by the streams from the higher lands were deposited and gradually the alluvial flood plain was built up. The coarsest and heaviest sediments were deposited first along the borders of the stream and the finer material was carried out and deposited farther away. Continued deposition of this type following repeated overflows causes the land to be built up rapidly near the streams and slowly in the inter-stream areas so that the surface is highest near the river and gradually slopes away from it (see profile). This accounts for much of the poorly drained areas away from the river and the early settlement along the slopes and natural levees, while the back areas were still unoccupied. The material of the natural levees being unconsolidated is very easily eroded.

#### DANGER CAUSED BY CHANGES IN THE CHANNEL

On every one of the many turns and bends throughout the whole 1200 miles, the river is constantly undermining and wearing away the outer bank of the channel in much the same way as the outer rail of a curve on a railroad is worn rapidly and must soon be replaced. The fine-grained, loose character of the soil, greatly facilitates the undermining action, especially during the irresistible rush of flood waters.

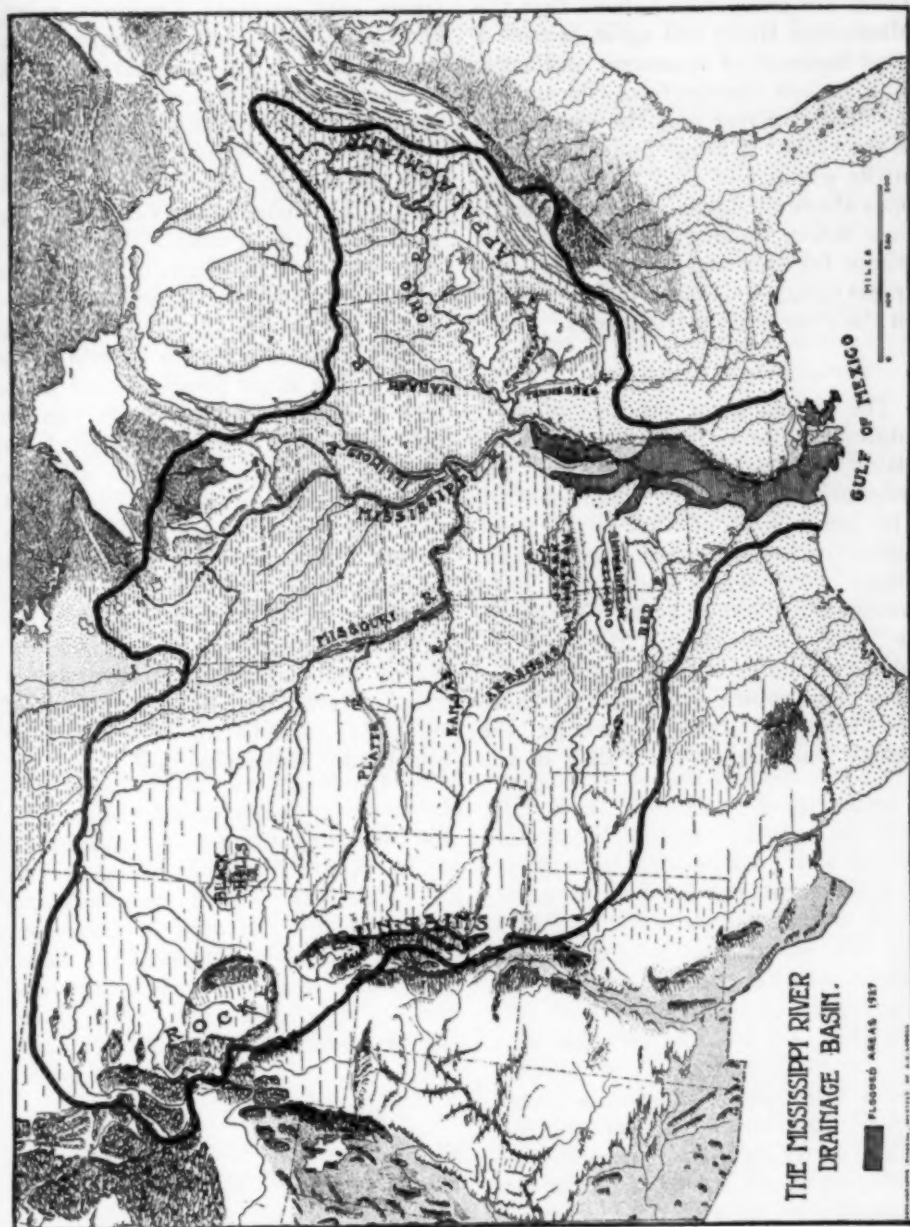
This habit of eating away its banks is perhaps the worst thing which can be charged against the Lower Mississippi, and presents one of the most serious problems in the whole question of control. Needless to say, the unceasing changing of the course is vitally important to the plantation owner, who sees his fertile land steadily vanishing, often at the rate of 400 or more feet a year along his entire water

front. It is still more important to the towns and shipping points located along the river. New Orleans is the only big city located directly on the river flat, and, fortunately for the city, it is at a place where the river's course is now comparatively straight. Other cities, like Memphis, Vicksburg and Natchez, are located on the high bluffs where the river swings close against the eastern side of its valley. These latter towns have secured immunity from floods, but even simple changes in the channel would deprive them completely of their water fronts and strike fatal blows at their prosperity.

Even the present extent of the river traffic demands that there shall be more or less villages directly along the river and steamboat landings at various points, but every one of these places enjoys only a temporary existence. Since the river current hugs close along the outer side of every curve in its course, it follows that the deepest water, and hence, the main channel, also lies near the outer bank. The natural result is that all steamboat landings and all important shipping points must be located on the outer banks of curves, as is found to be the case all along the river. The difficulty which lies therein is obvious enough, for with rapid undermining of the outer bank of all bends, the river is always tending to destroy the water front of every place so situated. The history of the landings below Cairo shows that practically every one of them has been driven back before the advancing river at the rate of 100 to 150 feet per year for the last quarter of a century.<sup>3</sup>

Much money and time have been spent on attempts to keep the river navigable. Trees and snags are removed; loose, slipping banks are protected by revetments of willow, boards or other material; and wing dams are built in order to narrow the

<sup>3</sup>Tower, W. S., "The Mississippi River Problem"; Bulletin of the Philadelphia Geographical Society, Vol. 6, 1908, p. 87.



channel and cause greater depth in the Ohio and Upper Mississippi. These have proven only partially successful. There are many who believe that the Mississippi River will again become a great highway of commerce and argue for a 14-foot channel from Chicago via the Illinois River and the great river to the Gulf. A barge line was started in the summer of 1927 on the Mississippi above St. Louis. It will be some time before we can predict success or failure for this and other traffic programs planned to renew transportation on the river and its tributaries.

#### FLOOD CONTROL

The second great problem of vital interest to those living on the flood plains of the Mississippi and its tributaries is that of flood control. The great flood of 1927 — the most distinctive of all — was one of some fifteen very serious floods that have occurred in about 50 years. Fernando de Soto's party found the river at flood, and many seasons of high water have been known since, notably those of 1785 and 1844. Although the people who live in the valley of the

Mississippi have many valuable resources, they also have a continental climate, usually changeable, but sometimes very erratic. Untimely rains, combined with melting snows or a long period of wet weather, followed by heavy rains over much of the valley, cause high water in the flood plain areas.

It should be emphasized that the area affected by floods is only a small part of the Mississippi Valley (shown by accompanying map). It is advocated by many that parts of the area so often submerged and so sparsely populated should be abandoned and all efforts be combined on attempts to protect the more populous and prosperous areas. If loss of life can be prevented, this would seem logical, for there is no more reason to ask the Government to protect an area subject to overflow and whose owner takes a chance than to ask that same Government to protect from drought or frost. However, the Mississippi is the great drainage artery of the Mississippi Valley and as such must ever be of great interest to the inhabitants of most of the area between the Alleghany and Rocky Mountains.

# The Improvement of Our Mid-West Waterways

By HON. HERBERT HOOVER<sup>1</sup>

Secretary of Commerce

**I**N the past three years I have addressed many in support of further development of our inland waterways. In fact the Secretary of Commerce is enjoined by the organic act creating that office to foster and promote the development of transportation. It is a subject that can interest only the serious-minded, for any contribution to public thought must be by economic reasoning, not by oratory.

I am concerned with this improvement because it will contribute to the wealth and economic progress of every section of the Union. It will contribute to the unity of the nation. It is of concern to every one of our millions of farms and homes. The Mississippi Valley Association, representing all parts of the Mid-West, has been long devoted to the promotion of flood control and inland waterways; it has a record of great accomplishment. But the work is far from complete, and that work and mine requires that we should formulate and support plans not only for tomorrow but with vision of the distant future, for the day is here when we must look to the welfare of not alone 115,000,000 Americans of our generation, but we have a responsibility toward the 150,000,000 Americans who will be living in our children's time.

## MISSISSIPPI FLOOD CONTROL

The most important event in our national life during the past year has

<sup>1</sup>An address before the Mississippi Valley Association, St. Louis, Missouri, Monday evening, November 14, 1927.

Seldom do we reprint addresses in *The Annals*. But this address is too good to miss.—C. L. K.

been one which bears directly upon the development and control of our great rivers—that is, the Mississippi Flood. Sad and heartrending as it has been in its human aspects, severe and discouraging as have been the economic losses, it at least serves to bring home to the American people the increasing dangers to a growing population which lurk in our great streams if they be not adequately controlled.

I had the honor to be chosen by President Coolidge to organize and direct the relief activities which were supported so generously by our Government and the people at large through the Red Cross. No man could occupy that responsibility and have witnessed its scenes without being deeply moved to the human necessity of immediate and final prevention of its ever recurring again.

I have little need to dwell upon the causes of the great flood and its destruction. But there is an aspect of the flood that has perhaps not been sufficiently emphasized. The destructiveness of this flood was partly due to the rapidly increasing settlement of the flood area. This increase will continue, and such dangers to our country will increase as years go on unless we establish adequate controls. The great delta of the Mississippi River, which in reality extends from Cairo to the Gulf, has been for untold centuries the spillway for our interior rivers. They spread their annual floods over these richest of alluvial lands for a thousand miles long and from 20 to 150 miles wide. With the pressure of population, our people have, more especially



in the past quarter of a century, invaded the flood region. With courage and resolution they have overcome the swamp and forest, they have converted it into homes and productive farms. And in so doing, they have of necessity crowded out the annual floods with peace until finally they have forced the river in flood time to confine itself to its own channel.

I need not recount to you that, with the unprecedented volume of water of this year, these barriers crumpled up and the river spread itself again over its old flood area. Some 750,000 of our people were compelled to flee their homes in jeopardy of their lives. Damage to their farms and villages amounted to hundreds of millions.

Such a flood 25 years ago would have wrought far less destruction simply because there were fewer people and less property in its track. If we look into the future but a quarter of a century, we can envisage even far greater dangers than those past. We may not have so great a flood again for many years to come. But the richness of these soils and the pressure of our growing people will some day see 5 or 10 million of them settled under these levees. No one can contemplate these millions of our fellow citizens living in such jeopardy without adequate and final protection.

I believe the whole of the United States is unanimous in that we must undertake such engineering works as will give security—not only now but for the future. Our people have arrived at this conclusion because of their warm sympathy for the welfare of their fellow citizens. But, viewed from the more narrow point of view, the destruction of property is the loss of the entire nation—it is not solely the loss of the individual sufferers. The loss of several millions of acres of crops in this flood deprived the American people of

just that much goods which they might have otherwise consumed or exported, and again every worker and every farmer in our country to some degree was a loser through the decreased buying power of flood sufferers themselves. Every investor in railways and industry of the South lost something.

Our able engineering staff under the leadership of General Jadwin will in a few weeks have consummated their plans by which these floods can be controlled. And it devolves upon my colleague, Secretary Davis, to present them to Congress as the basis for legislation.

I am confident of the outcome that we shall as a nation within the next few months have taken such action as will not only give assurance of safety to the whole of our fellow citizens in the flood territory, but that will give such security as will guarantee the continued development of this great region.

#### INLAND WATERWAYS

But, in our necessity to remake and energetically construct such flood control works as will guarantee protection against these calamities, we must not be diverted from our march to the improvement of our inland waterways. That is as important to the suffering flood states as it is to our people elsewhere. Indeed, we have made great progress in the past year in this great improvement of our national estate, both in actual construction and in advancement of public support.

It is perhaps unnecessary to recount that every great national development in transportation must pass through many stages. There must be a situation to be remedied, there must be compelling cause for action; there must be a determination of the remedies that are available; there must be a definite plan conceived; the works must be constructed; and finally they must be used.



## THE SITUATION TO REMEDY

The urgency of the situation to be remedied, to a large degree, grows from the economic shifts due to the war which have brought a new setting to all our mid-Continent. The necessarily large advance in our railroad rates as a result of higher wages and cost of materials since the war serves to set a row of tollgates around the Middle West. There is thus a charge, new with the war, against all goods coming into the Mid-West and all goods going out. It is not as if all parts of the country and all parts of the world had been placed under a similar tax, for that is not the case.

You will find that ocean rates have returned to a prewar basis—and thus the folks of seaboard countries do not pay these additional tolls to and from market, and therefore they have today a greatly increased competitive advantage over their fellows in the interior. This, together with the completion of the Panama Canal, the full effect of which was not evident until after the war, all combine to distort the economic setting of this whole Mid-West.

Mid-West agriculture and Mid-West industry have been placed in a new relationship to different parts of our country and to the world markets as a whole. If we would restore these former relationships, we must find fundamentally cheaper transportation for our grain and bulk commodities which we export and the raw materials which we import into the Mid-West.

I can possibly make this problem of economic shifts more clear by example: a great part of the agriculture which competes with our farmers lies to a considerable degree in Argentina, Australia, Eastern Europe and India. Those agricultural areas are all nearer to seaboard and their ocean rates to the common markets remain the same as

prewar, while our rail rates to seaboard on wheat, for instance, have increased about 8 to 18 cents per bushel. Therefore foreign farmers reach European markets at a less cost in proportion to prewar than can our Mid-West American farmer. In actual figures, the competing farmers from the Argentine, for instance, have felt an increase in rates of only 2 cents per bushel.

I believe there is general agreement that the cost of transportation is a deduction from the price the farmer receives at the world's markets—and besides that the price at which he realizes his surplus in foreign and seaboard markets makes the price of his whole product at home, so that the effect of increased transportation rates to these markets is far greater than the bare amount as applied to exports only. It is an enormous sum when applied to our crops and is one of the contributing causes of the farmer's postwar difficulties. It is not all the farm problem, but it is a substantial part.

While the Panama Canal has carried great benefits to our people, we cannot ignore the fact that it has also contributed to distort the competitive relationships of the Mid-West and our seaboard business and industry. It has drawn the East and West seaboards much closer together by greatly decreasing transportation costs and therefore tends to draw an area of Pacific's business formerly enjoyed by the Mid-West toward the Atlantic States. We can roughly visualize the combined effect of the canal and higher rail rates if we set up a new measuring unit in the shape of the number of cents which it takes to carry a ton of staple goods at present rates. Using that measuring rod and taking the cheapest routes, we find that before the war New York was 1904 cents away from San Francisco, while now it is only 1680 cents away. But a given Mid-West point, which

was 2600 cents away from the Pacific Coast before the war, is today 3114 cents away. In effect this Mid-West point has moved 514 cents away from the Pacific Coast while New York has moved 224 cents closer to the Pacific Coast. A similar calculation will show that in the same period this Mid-West point has moved 694 cents away from the markets of the Atlantic seaboard and South America.

All this causes certain types of Mid-West business to migrate to seaboard. It steadily tends to establish manufacture nearer to seaboard and farther from the heart of agriculture, to the mutual disadvantage of both. It likewise has a tendency to limit the area of Mid-West wholesale distribution. Individual merchants and manufacturers in the interior can give you many instances of it all.

From all this serious shift in economic currents in its effect on agriculture and upon business we surely have something worthy of our best effort in remedy. And remedy lies as I have said in finding cheaper transportation in bulk products of agriculture and in raw materials.

#### THE REMEDY

With the higher cost of labor and materials, we cannot expect any consequential reduction in our railroad rates without ruin to that vital circulating system. Our railways have reached the highest efficiency in their history, and we must maintain them in that condition. We cannot close the Panama Canal. Nor can we raise Atlantic Ocean and other sea rates, because the standards of living in the rest of the world, unlike our own, have not increased over prewar, and therefore the cost of operating foreign overseas shipping is not far from a prewar basis.

In any examination of our country for remedy, we have naturally turned

to a consideration of the magnificent natural waterways which Providence has blessed us with. It is therefore our conception that we should deepen our rivers to permit modern barge transportation, deepen the outlet to the Great Lakes to permit ocean-going shipping, and to connect them all together into a definite transportation system.

#### THE PLAN

Your Association has for long years steadily fostered and forwarded the development of inland waterways. But the national mind perhaps, until in the past two or three years, has conceived waterways development as local projects of some immediate near by improvement, instead of in the wide vision of a comprehensive system of 12,000 miles of connected inland water transportation reaching from the Gulf to the Northern frontiers and from the Lakes to the Atlantic Ocean.

The plan can be simply stated:

It is to deepen the 9000 miles of the Mississippi and its tributaries to minimum depths of 6 to 9 feet so as to permit modern barge service—that is, the Mississippi system.

The construction of the St. Lawrence shipway from the Lakes to the Atlantic, thus opening every lake port to the vessels of the world over 3000 miles of deep waterways—the Great Lakes system.

There are other important waterway improvements of less size which bear directly and indirectly upon the Mid-West. The stabilization of lake levels and deepening of the channels so as to permit full ship loading within the Lakes, the intracoastal waterways and the continuous development of our harbors are all works which must go forward some time but are not our particular subject tonight.

During the last year we have made

great steps in progress of these plans and in the consummation of some of them. Congress has authorized the remaining unfinished links in the Mississippi system. It has increased appropriations available to \$20,000,000 per year for their execution. If these appropriations continue we should see the improved Upper Ohio linked with the Lower Mississippi in another two years. We should see the Missouri steadily deepened to Kansas City and as far above as traffic warrants. Already barge navigation has begun upon the Upper Mississippi to St. Paul and Minneapolis. I am in hopes that in not more than five years we shall see Chicago connected to the Mississippi and thereby with the Gulf by a nine-foot channel. By these works and the gradual improvement of channels up the other tributaries as traffic warrants, we shall at last replace a series of disconnected segments of river improvements into a great transportation system.

Curiously enough, I find that some of the press in outlying parts of the country still have the lingering notion that we are trying to restore the romantic steamboatin' days with gay river steamers whistling down the reaches, with possible Mark Twains aboard. I am not adverse to romance when it can be had without cost to the taxpayers. What we are trying to do lacks that color, but carries much more freight. What we want is to deepen our streams so that they become unfailing channels for flocks of steel barges, shepherded by puffing tugs. It lacks splendor and the glorious adventure of the olden days, but each flock will carry at a single trip from 4000 to 16,000 tons—more than say fifty old-fashioned packet boats or more than five modern freight trains. It is no doubt the drab toil of modern commerce, but in this bulk and in this

mobility of units which can be sent to different destinations do we realize modern river transportation and modern mass handling of commodities on our inland water.

Two years ago I was able to promise that this traffic and these benefits would flow as soon as we had connected up the segments of this great Mississippi system. But in so short a time as two years the demands upon even the disconnected segments have grown beyond the capacity of our equipment and already we begin to see a complete confirmation of our assurances. Last year over 10,000,000 tons of commodities moved on the Lower Mississippi and nearly 20,000,000 tons upon the Ohio. The present gap in the connection of these great segments is just as if a stretch of narrow gauge line were introduced into the New York Central main line.

Recent delegations of shippers to Washington showed that there are hundreds of thousands of tons more unable to move because of insufficient equipment on the river—and we must bear in mind that we have not yet felt the effect of the fully developed system for such great centers as Kansas City, Chicago, Pittsburgh, Cincinnati, and Louisville and their hinterlands are not yet connected either with each other or with St. Louis, Memphis and New Orleans.

This should settle once and for all the contention of our critics that there was no demand in goods to be moved upon the rivers.

A component part of our inland system is the Great Lakes. In them we have the mightiest inland waterway given to any continent. They bore last year over 115,000,000 tons of traffic.

But the full influence of the Great Lakes system in remedy to the economic difficulties of the Mid-West is

dependent on the deepening of the channel of the St. Lawrence River to permit deep-sea shipping from the Great Lakes into every port of the world. The consummation of such an undertaking would represent the final step in 150 years of battle for the removal of barriers in this great waterway to the Mid-West. It would give an effective outlet for eighteen of our states to the North Atlantic.

The Joint Board of Engineers have submitted to their two governments their report upon this work. Their conclusions were that this route is the most beneficial and efficient one, by large margins the cheapest to build and operate. In accord with the compelling interpretation of the facts, our American Commission, of which I have the honor to be chairman, has recommended that its construction be undertaken.

Some months ago we requested the Canadian Government to enter these negotiations. However intricate the questions may be which are involved in these international relations, I am confident that they can be solved upon the ample foundations of broad mutual interest and good-will which have signalled our two nations since our birth. We have for a century coöperated with each other in constant improvement of this great highway. It has been part of our joint endeavor in the development of the new civilization on this Continent. This final step is a task worthy of the strength and purpose of the two sister countries who have in two centuries already overcome countless obstacles in implanting the most helpful civilization of history.

#### THE OPPOSITION TO WATERWAY DEVELOPMENT

You will find three main schools of opponents of the vigorous development of our water transportation—first,

those who doubt that it will yield the economic benefits which we assert; second, those who feel that it implies undue burdens upon our taxpayers; and, third, those who fear that these developments might injure our magnificent railway system.

The question is whether anyone of all of these projects are justified. We are no longer on theoretical grounds when we assert that Mid-West transportation of bulk materials will be cheapened by these means. We have the actual beginning of experience. During the past year we have seen the Government barge line operating successfully upon the St. Louis-New Orleans segment with a rate down river on wheat about 8 cents a bushel less than by rail, and a rate up river on imported commodities of as much as 10 cents per hundred pounds less than by rail. During the past few months we have seen the barge line extended to St. Paul and Minneapolis, 12 cents per bushel lower by water than by rail, and we have seen the up river rates on coffee and sugar 16 cents per hundred pounds less than by rail.

While we can point to these benefits, we shall not come into full realization of these services even on the Lower or Upper Mississippi until we have completed the other segments of the system. It is only then that we shall have diversified our traffic, established reserves of equipment, felt the benefits of private enterprise, which will give us the full values of cheaper transportation costs.

I believe that the statement often made that, by the modernization of the Mississippi and the Great Lakes systems of waterways, we shall decrease the freight on grain to the world markets by 10 cents a bushel is not far wrong. And by so doing, we should increase the price of all grain to the farmer by 10 cents per bushel, and this 10



cents is the profit end of the price. One single year of such increase to our Mid-West farmers would more than equal the entire capital outlay which we propose. I doubt if since the days when we transformed transportation from the wagon to the railroad have we seen so positive an opportunity to assist the prosperity of our people.

As to those who complain of the capital cost upon our taxpayers, it may be recalled that no great engineering projects can be consummated in a year. The completion of these projects are spread over from two to ten years, even if they were all authorized tomorrow. I dare say the whole of our water transportation projects I have mentioned could be accomplished with an increase in our present annual expenditure upon rivers and harbors of 20 millions a year. That a nation with an annual income of 90 billions can undertake to spend a tenth of one per cent of its national income in such works requires little argument. Upon this point we can do no better than quote the most successful statesman in economy in our national history—President Coolidge—who in his last message to Congress said, in referring to these very projects: "Expenditure of this character is compatible with economy. It is in the nature of capital investment."

Another criticism to which I have given great consideration is that the opening of these great waterways would endanger the stability of our railway system. Taking the country as a whole, the railways must ever bear the major burden of our goods traffic. And there are many classes of goods which will always go by rail even parallel with the waterways. And here is an old saying that is true: "New transportation facilities create business." It is well proved by our new highways.

At one time in our history we practically abandoned the highways and

waterways for the railways. The invention of the gas engine has restored our highways and multiplied their traffic ten thousandfold. Yet the total volume of passengers and goods on our railways has increased threefold in 25 years; the next quarter of a century promises even a larger addition to our population than the last 25 years. The railways must provide for the major burden of this increase, and I believe most railway operators agree that our railways can well be supplemented in their provision for this increased traffic by fully developed waterways. I have no fear for their prosperity.

#### NATIONAL ORGANIZATION

There must lie before us constantly the necessity to so organize these projects as to accomplish them with rigid economy and high efficiency. I am convinced that we have come into an entirely new era in the development of our water resources and therefore we should give thought to the whole basis of our governmental organization which bears upon control and execution of these developments, if we would have economic and efficient execution; if we would confine ourselves in rotation to the works most urgently needed; and if we would do justice by private enterprise and our taxpayers. One of our difficulties in the past has been to secure well-thought-out plans and policies in the development of our multitude of different water resources. And even when plans have been adopted we have incurred unpardonable wastes of money through lack of continuity in action. We need public understanding that appropriations for these projects must go through to completion or that they should not be undertaken.

Another of our problems requiring immediate consideration is the increase of equipment upon the river. We need to develop this question in such fashion



that it shall ultimately be taken over by private enterprise because in the long run it is through private competition only that we will have efficient use of the waterways. The Government undertook to pioneer the equipment for a modernized river through the barge line. The pioneering stage is not over and may not be over for some time. We must devise ways and means of larger equipment and devise the program for its ultimate taking over by private enterprise.

A further problem presents itself in that modern investment and our increase of population have introduced many new and complex factors into the planning and construction of some of these water improvements. So long as we are concerned solely with improving navigation upon our streams, the organization and administrative problems are comparatively simple. It is a function assigned to the Federal Government and administered by one Federal agency—the Corps of Engineers. But today on many of our streams we have other problems besides navigation. There is flood control, reclamation and irrigation which will loom even more largely 20 or 30 years hence when we shall want more land. We have problems of water distribution and water rights and domestic water. Beyond this, private agencies are engaged in electrical power development under government permit.

The most casual study of this subject will show that every different river in the United States has possibilities of development in from one to five of these particulars. Often enough these different interests conflict. The unit of development must be a drainage basin if we are to secure the full values from these our noblest resources.

Now if you will study our Federal and State governmental agencies that have authority in these questions, you

will find a most appalling lack of co-ordinated action. In our Federal Government relations to these problems of navigation, flood control, power, domestic water, reclamation and irrigation lie in four separate agencies of the Government. You will find that within our State governments we deal with these questions by from two to five different agencies. You will find also that county and district organizations—many of them—have authority on these questions.

Beyond this you will find that often enough from two to twenty states are interested in a single drainage. In other words, I have found it possible to compute that as many as thirty different independent governmental agencies may be interested in the development of a single drainage.

There is at times bitter conflict between these agencies, and between states. I could take much of your time illustrating the friction which has grown up—the litigation which fills the courts and the conversion of these technical problems into politics with all of its inability to solve what are fundamentally engineering questions. We have in many cases abandoned the pouring of cement in order to pour out our emotions.

I need cite no greater instances than the Colorado River, the Chicago drainage diversion and even the Mississippi Flood, because the sacrifice of flood control to reclamation has been one of the contributory causes of that disaster.

I am not one of those who believe that we should ruthlessly uproot institutions, services and relations between our states and the Federal Government in order that we may attain a paper perfection in plans of organization. What we really need is that we should build within these agencies the necessary links of coördination in such manner as will maintain both our local

government and national responsibility yet secure the coördinated development of each drainage.

Two years ago I made a tentative suggestion upon which every event since that time has brought further confirmation as to its necessity. That was that we should create separately upon a half dozen of our great drainages, where multiple problems occur, advisory commissions on which not only the various branches of our Federal Government should be represented, but that the time has come when the State governments concerned should be represented and where necessary local authorities should also have a voice; that it should be the duty of these advisory commissions to determine broad policies upon which the development should take place, that they should develop plans by which the different agencies of navigation, flood control, power, reclamation and irrigation and domestic water should proceed; that they should determine the economic urgency of the different segments of such plans. We have already in the Mississippi and St. Lawrence Commissions a start upon this basis of organization the former having to do with flood control alone.

I am not proposing any additional engineering staff. The material already collected and the large number of surveys ordered by the last session of Congress are a long stride toward the full provision of technical data. I do not propose that the new commissions should have any administrative authority—their only task should be to present the plans they formulate to Congress, to the states and to the public at large. Once our legislative bodies have taken action, then the task of construction and operation should be left to responsible departmental agencies or private enterprise and not to boards or commissions.

These administrative suggestions are not proposals for centralization of government but decentralization; they are not proposals to displace the authority of Congress, but to assist an already overworked body; they are not proposals of more than trivial expense, but safeguarding from the waste of hundreds of millions in ill-planned development and loss of our full water resources.

#### CONCLUSIONS

I have stated on another occasion that the consummation of these beneficent projects are the greatest engineering undertakings of our history. They are more than that—they are undertakings worthy of the effort of mighty nations. There is nothing that so lifts the spirit, the ideals and the faith of a people as confidence in their ability at great undertakings and the proof of this ability through fine achievement. It is the sort of display of national might and greatness which advanced courage of men. There is nothing that should so appeal to the imagination of our people as the rediscovery of the resources of our continent through the application of the great tools science has given us. It is a sore need of the vast inland empire whose populations have a right to every contribution that can be made to their welfare and their prosperity. In the distribution of recovery from the war, our industrial sections have been more fortunate than the agricultural sections and their situation needs be met with no narrow spirit.

The development of our waterways will enlarge the wealth and income of all our people, will make for better homes and happier lives. It will further consummate that fine promise in the Constitution "to create a more perfect Union."

And, finally, I may again recall a statement of President Washington in

recounting one of his pioneering journeys to this same Mid-West. He said this: "Prompted by these actual observations, I could not help taking a more contemplative and extensive view of the vast inland navigation of these United States, and could not but be struck with the immense diffusion and

importance of it, and with the goodness of that Providence, which has dealt her favors to us with so profuse a hand. Would to God we may have the wisdom to improve them."

If we in our generation have so great a vision as the Father of Our Country we shall do it.

# The Report of the Committee on Mississippi Flood Control Appointed by the United States Chamber of Commerce

By FREDERIC A. DELANO

Chairman, Washington, D. C.

**T**HE salient points of this Committee's report and its conclusions are:

(1) To begin with, the Committee attempted to make a catalogue of the floods which have occurred in the last 200 years. During 150 years of that time, one must depend upon somewhat indefinite historic records, accurate enough, however, to indicate that as often as every ten years or so these floods were very serious. Since 1879, the year the Mississippi River Commission was created, precise data have been available. These show that there have been in the last fifty years seven floods in the main river which were serious enough to be characterized as important.

(2) The seriousness of these floods and the resulting damage have satisfied the Committee that the work of protection has been inadequate either in its conception or execution. In trying to satisfy itself upon this point, the Committee came to the conclusion that a work of such magnitude must be under a centralized control with a single responsibility for its maintenance as well as construction. It has been stated without contradiction that even in this last terrific flood, no levee constructed under the present specifications of the Mississippi River Commission has given away; that the levees which have given away were levees which were either faulty in construction, inadequate in height and strength, or were not so protected with revet-

ment as to withstand the terrific onslaught of this flood. The lack of centralized control has naturally led to waste, so that not only have the communities greatly suffered in each flood period, but much of the work that had been done has been thereafter largely undone.

(3) It became evident to the Committee that the work of control, adequately conceived and properly centralized, must be undertaken on a continuing basis. The commission undertaking the work must approach the subject as any great engineering construction must be undertaken, as, for example, the Panama Canal. A general method of dealing with the project must be agreed upon, the work must go forward and funds be made available on a progressive basis. Because the work requires in some cases special and heavy machinery, contracts must be let, the execution of which will require at times two or three years. In no other way can we deal with so great a problem either effectively or economically.

(4) A difficult angle of the problem presented itself when the Committee considered the limitations of the work which it was ready to recommend to Congress should be undertaken solely by Federal authority. The Committee's recommendation that the work should be under Federal control has already been explained, but the justification for that recommendation lies largely in the fact that the lower

Mississippi River (between Cairo and the Gulf) drains the water from thirty-one states. This part of the river may be termed the *main trunk line sewer* for 60 per cent of the area of the continental United States. It is so none the less because it receives a large precipitation within its own immediate drainage area. This vast drainage system cannot be considered as a local matter, and yet if you undertake to enlarge it by demanding that the control of the Federal Government shall include some of the tributaries, for example, the upper Mississippi, you at once get into trouble, for there is no more reason why the Federal Government should protect the upper Mississippi River in which five states are involved, than it should protect any other interstate stream. The same is true of the Ohio River, the Missouri, the Arkansas and the Red River.

(5) It was evident that a serious flood in the lower Mississippi River not only operated to destroy commerce upon the River itself for a considerable period of time, but what was far more serious, it destroyed interstate commerce by rail and highway along the River and across the valley over a very wide extent of country.

(6) Finally, your Committee strongly recommended in its report that the work of flood control should be considered by itself, not associated with any other projects however meritorious; that it should be put in the hands of a highly competent commission,

with the most competent engineering staff available. Incidentally it should be said, this is not in any sense a criticism of the Mississippi River Commission or of the Engineer Corps of the Army, both of which have done excellent work with conditions and limitations what they were.

With this explanation it will be readily understood why the Committee made to the Chamber four major recommendations which are now being considered in a letter ballot by the entire membership:

- I. That the Federal Government should hereafter pay the entire cost of constructing and maintaining works necessary to control floods of the lower Mississippi River. (For purposes of this report from Cairo to the Gulf.)
- II. That the Federal Government should assume the sole responsibility for locating, constructing, and maintaining such works.
- III. That there should be an adequate appropriation to insure efficient, continuous and economic work, the funds to be available as needed.
- IV. That flood control of the Mississippi River should be dealt with in legislation and administration upon its own merits, separate and distinct from any other undertaking.

The report of the Committee<sup>1</sup> follows:

<sup>1</sup> The members of this Committee were as follows:

#### PERSONNEL OF COMMITTEE

DELANO, FREDERIC A., *Chairman*: Engineer, of Washington, D. C.; formerly a railroad executive and president of the Wabash Railroad; appointed a member of the Federal Reserve Board upon establishment of the Federal Reserve System, resigning in 1918 to enter Army; on staff of the director general of transportation in France; recently receiver for the United States Supreme Court in Red River Boundary Case.

LAMONT, ROBERT P., *Vice-Chairman*: Manufacturer, of Chicago; president, American Steel Foundries; director, First National Bank of Chicago, Armour and Company, etc.; during war, chief, procurement division, Ordnance Department; member, Chicago Association of Commerce, and



## THE COMMITTEE REPORT

*To the Board of Directors of the Chamber of Commerce of the United States:*

Your decision to appoint this special committee was made at a time when the Mississippi River was in the midst of one of its most destructive floods. The interest of the American people was at its height, and the fullest measure of sympathy was being extended to the stricken people in the Mississippi valley. All means of aid were being considered and organizations were being perfected to extend such aid and give relief. It is inferred from the wording of the resolution passed at the annual meeting of the National Chamber in May, dealing with conditions arising from the Mississippi River flood, that any phase of this problem which the committee might consider appropriate for Chamber action should be studied.

The immediate and generous response of the American people to the President's appeal for funds has, under the very prompt and efficient work of the American Red Cross in the relief of suffering, prevented epidemics and furnished food and shelter to the people whom the flood suddenly bereft of their homes, cattle, and other possessions.

Before the flood waters had begun to recede, steps had been taken toward rehabilitation.

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formerly vice-president, Illinois Manufacturers Association; director, Chamber of Commerce of the United States.

**BENT, ARTHUR S.:** Engineering contractor, of Los Angeles, California; senior partner, Bent Brothers, and president, California Glazed Cement Pipe Company; formerly president, Associated General Contractors of America; director, Chamber of Commerce of the United States.

**BUTTERWORTH, WILLIAM:** Manufacturer, of Moline, Illinois; president, Deere and Company; formerly president, National Implement and Vehicle Association; vice-president of the Chamber of Commerce of the United States for the northern central states.

**COUCH, H. C.:** Engineer, of Pine Bluff, Arkansas; president, Arkansas Light and Power Company; vice-president, Bankers Trust Company, Little Rock, Arkansas; chairman, Arkansas Farm Credit Company; national councillor for Pine Bluff Chamber of Commerce in United States Chamber.

**DICKINSON, JACOB M.:** Lawyer, of Chicago; formerly Secretary of War, president of the American Bar Association, receiver for Rock Island Lines, etc.; vice-president, American Society of International Law.

**ELLIS, ROBERT R.:** Wholesale merchant, of Memphis, Tennessee; president, The Hessig-Ellis Drug Company; formerly president, Memphis Chamber of Commerce; vice-president of the Chamber of Commerce of the United States for the southern central states.

**HINES, WALKER D.:** Lawyer, of New York City; president, Cotton-Textile Institute; formerly chairman, board of directors, Atchison, Topeka and Santa Fe Railroad; formerly Director General of Railroads; recently arbitrator under Peace Treaties of questions relating to river shipping and investigator under League of Nations respecting navigation on Rhine and Danube.

**LONSDALE, JOHN G.:** Banker, of St. Louis, Missouri; president, the National Bank of Commerce, St. Louis; director, St. Louis Reserve Bank; member, Commerce and Marine Committee of the American Bankers Association; director representing Finance Department, Chamber of Commerce of the United States.

**MEAD, DANIEL W.:** Engineer, of Madison, Wisconsin; professor of hydraulic and sanitary engineering, University of Wisconsin and consulting engineer in these fields; member of the former Red Cross Commission to China on flood protection and formerly consulting engineer, Miami Conservancy District.

**PARKER, JOHN M.:** Cotton planter and cotton merchant, of New Orleans; former Governor of Louisiana; formerly president, New Orleans Board of Trade, Mississippi Valley Association, etc.

**PERCY, LEROY:** Lawyer and cotton planter, of Greenville, Mississippi; former Senator of the United States; director, St. Louis Federal Reserve Bank.

**SLOAN, MATTHEW S.:** Engineer, of Brooklyn, New York; president, Brooklyn Edison Company; member, American Institute of Electrical Engineers; director, Brooklyn Chamber of Commerce; director representing Natural Resources Department, Chamber of Commerce of the United States.

**STONE, ALFRED H.:** Cotton planter, of Dunleith, Mississippi; vice-president, Staple Cotton Cooperative Association.

The Honorable Herbert Hoover, Secretary of Commerce, whom the President had placed at the head of the government's field activities, had organized efforts in this direction. He was receiving a large measure of assistance from the banks and other financial interests of the country, working directly with him or independently through organizations which they had initiated. The work of rehabilitation received further impetus through the Flood Credits Corporation,—the organization of which was brought about through the efforts of the National Chamber.

#### FLOOD CONTROL

Measures of immediate relief having been put into effect, and the lines of economic rehabilitation established when your committee was created, the sole remaining problem which has commanded our attention has been that of arriving at "a program which will insure, so far as is humanly possible, a permanent solution" of floods of the Mississippi River.

Almost fifty years ago the federal government became actively engaged in Mississippi River work through the creation of the Mississippi River Commission. The repetition of floods since that time has impressed more and more strongly upon business interests of the country and the general public the national character of this flood control. This statement is supported by the following quotations from "Bradstreets" published April 17, 1897, exactly thirty years previous to the recent flood: "The attention which the subject of Mississippi River overflow is receiving at present is certainly not out of proportion to the vast interests, both human and financial, which are involved, and it seems encouraging to note the practical agreement that whatever is to be done, whether in the strengthening of the present levees or the devising of new and more efficacious plans of controlling the river, should be under national direction."

The committee has been impressed with the insistent demand throughout the nation that the recent flood should not go the way of other floods and be merely recorded in history as "the record flood of 1927," but that it should be remembered as the flood which aroused the nation to its sense of responsibility and directed the forces which will ultimately prevent a repetition. Our present wealth, our increasing national solidarity, the interdependence of various sections of the country, the increasing importance of our great arteries of commerce—our rivers, railroads, and highways; our ability to construct great public works with the highest engineering skill, and our quickened national consciousness,—all call for the removal of this flood menace.

The history of the last twenty-five years has illustrated the fact that we, as a nation, have come only slowly to grasp the magnitude of this flood menace. Rather tardily, it must be admitted, have we come to see that it is something beyond the capacity of the states immediately affected, and the concern of the nation as a whole. As recently as 1917, the federal Congress appropriated forty-five million dollars, which was expected, with the addition of approximately equal expenditures by the local interests, to complete the system adequately. However, only six years thereafter, a further sum of sixty million was appropriated in the expectation of completing this big undertaking. Now we learn that the floods of 1922 and 1927 largely wiped out the expenditures to date, and today we are face to face with the fact that we have either spent too little or too much—too little if we are to do this work effectively, too much if we are doing any less.

In attempting to answer the question of why past efforts to control floods have failed, your committee has made a study of flood control efforts on the Mississippi River, going back through two centuries of levee construction to the time when New Orleans, just founded, took measures through levees to protect itself from the Mississippi. It has reviewed the studies of others in dealing with flood control measures on streams in foreign countries and compared these measures with the policy adopted on the Mississippi. It has considered the Mississippi watershed as a whole, taking into account its climatic and rainfall characteristics, analyzed these according to basins and weighed the flood conditions of the main tributary streams, and their probability of synchronizing so as to create even

greater floods in the main stream. It has reviewed such river phenomena as are particularly applicable to the great delta region.

Besides the physical data and engineering work which have a bearing upon the lower Mississippi River, the committee has caused a complete study to be made of legislative, financial, and administrative measures which are important factors in this flood control problem.

As a means of getting an understanding of the physical, financial, commercial, and economic questions involved, the committee visited the flooded area. Meetings were held at which local districts presented their problems, numerous engineers—federal, state and local—were interviewed and in some instances accompanied the committee on its visits to crevasses and the chief points of interest in the devastated regions. Senators, congressmen, governors, state legislators, and men prominent in industry,—all contributed to the fund of information which the committee obtained. Much material and various plans for controlling floods were received and have been considered.

Although the direct mission of the committee was to deal with facts affecting flood control, mention must be made of other facts of national interest evident throughout the trip; the extent of human suffering, the wonderful heroism and self-sacrifice exhibited, the undaunted courage of the people in facing the future in spite of the physical and financial disasters. The flood was a great object lesson proving the innate generosity of the people. It was an object lesson of the stability of our social structure. The orderly conduct of the colored race, who were by far the greater number affected, was particularly commendable.

#### FLOOD CONDITIONS

The committee would be glad if it could give an adequate picture of the force and extent of the flood, but to do so is not possible. Nothing short of actual experience with the waters themselves could give this. The committee traveled for days through regions where every house bore at a height of from two to ten feet the brown line, indicating the height of the water. Where the flood was at its worst, houses were destroyed, or carried miles from their foundations. The committee saw millions of acres of rich alluvial soil covered with a mass of cockle burrs, man-high, where before there had been profitable crops. The total estimated area flooded is equal to the combined area of the states of Massachusetts, Connecticut, Rhode Island, Delaware and Maryland. The quantity of water which poured through this valley was the equivalent of ten streams the size of Niagara flowing for a period of four weeks. The statement was made in one of the addresses that at one point in Louisiana it would have been possible to cruise in a motor boat for two days out of sight of land.

What the committee saw was striking evidence of the fact that the Mississippi River drains 42 per cent of the entire area of the United States,—an area in which occurs some of the heaviest rainfall,—rainfall that over extensive areas sometimes equals two feet in less than two weeks.

The work of rehabilitation has gone on rapidly. Roads have been made passable, bridges have been replaced with temporary structures, and to some degree some kind of a crop has been produced over much of the land that was flooded. The committee saw places where there had been three, four, or five floods during the year; but notwithstanding this the people desired to remain on the soil and "come back" as agriculturists. They have confidence in the future of this region.

Determination of the practicability of flood control received the committee's fullest consideration; for on such practicability must rest the whole program of flood control.

#### FLOOD ELEMENTS

The committee considered the periods of flood occurrence, their extent, the factors that cause floods, probable maximum floods that must be provided for, and river characteristics. Tables, charts and tabulations dealing with these subjects are presented in the appendices.

The oft repeated statement that the effect of the levee system has been to raise the bed of the river itself has been carefully checked and found to be unsupported by the evidence for on this point, the committee is assured by those who have been making observations and studies over a long period of years that such is not the case.

#### NECESSITY FOR CONTROL

Types of flood control, such as levees, spillways, by-passes, outlets, and combinations of these different methods, have been considered, together with other plans for control, including reservoirs and reforestation on the headwaters of tributaries.

The committee has not attempted to develop a plan of its own, but has directed its attention to determining whether it is practicable to control floods at reasonable cost by a system of levees, spillways, outlets, etc. After listening to many of these proposals and securing the judgment of the highest engineering talent in the country, both governmental and civilian,—federal, state and local,—the committee is impressed with the unanimity of opinion that adequate control of the Mississippi River is practicable.

#### RESERVOIRS, ETC.

The extent to which reservoirs, reforestation, etc., on the tributaries and headwaters would assist in the control of floods in the lower Mississippi is a controverted question. The committee, after considering this, came to the conclusion that, even if such measures should prove helpful, not only would their accomplishment require many years, but they should be considered as supplemental aids contributing an additional factor of safety in the future control of floods.

In seeking the reason for failure to control floods thus far, the committee has traced the history of development of government policy, both local, state and federal, in the construction of levees along the Mississippi River. It has traced this development from private levees erected at individual expense of the plantation owners to the formation of levee districts, and finally to coöperative building by the federal government and local levee districts.

When levee construction began at New Orleans, in 1717, small earthen dikes of from four to six feet in height were all that were necessary to afford protection from floods. With the general development of the country and the action of other regions to protect themselves from floods, the vast areas which previously had afforded storage for the river were removed, and the history of the river shows a constantly increasing height of river flood crest. During this period the nation has progressed from a sparsely settled territory to one thickly populated with prosperous cities, covered with a web of railroads, public highways, and telegraph, telephone, and power lines. The day has passed when the river can be permitted to overflow its banks, disrupt the commerce of the nation, and bring vast human suffering and economic loss to the flooded area. The immediate loss to the areas affected is not a determining factor; for, while an important factor, it is only part of the general derangement to the commercial life of the nation,—directly by the interruption of commerce, and indirectly by the economic loss which falls on every citizen.

Unfortunately this demand for flood control, calling for higher levees and for other methods of flood control in the interest, not alone of the affected areas, but of the nation as a whole, has outstripped the ability of the flooded areas to pay. The history of the levee districts shows that in some instances districts have taxed themselves beyond their ability to pay. While some regions are better able to pay than others, a proper system of flood control is exactly like a chain, no stronger than its weakest link. Of the twenty-nine levee districts stretching from Cairo to the Gulf, many have reached their full legal tax limit. Many not only cannot pay further sums for the greatly increased expense required, but cannot pay their existing obligations save at great sacrifice.

Thus far the total expenditures since 1882 of all agencies in the construction of levees amount to \$225,000,000; whereas the federal government has expended directly for



similar work \$65,000,000. The local agencies have expended nearly three dollars to every dollar spent by the federal government.

The investigations of the committee revealed the following reasons why the federal government should bear the entire cost of construction. The problem of flood control is national, particularly because it involves directly or indirectly the flow of commerce, north and south and east and west, in the very heart of the nation. The federal government is authorized under the provisions of the federal constitution to deal adequately with a problem so vital to commerce. Moreover, national defense requires the federal government to see that the nation may not be subject to the derangement of transportation and of the general destructive effects of floods upon the nation in time of war. One speaker asked the question, "What would have been the effect upon the efforts of the United States if the flood had come at the height of our activities in the World War?" and he asked further, "What would be the effect upon the nation if such a flood should happen when we were in a desperate struggle with foreign invaders?" During the recent flood, operation was suspended from 10 to 120 days on 3000 miles of railroad.

The principle that the federal government carries a responsibility for control of floods of the lower Mississippi was recognized in the Mississippi River Commission Act of 1879, which set up that commission and provided funds for work on the Mississippi River. The condition of expecting the local districts to carry the major part of flood control work persisted, however, and the amounts spent by the federal government between 1879 and 1917 for flood control are as follows: federal government, approximately \$23,000,000; local levee districts approximately \$143,000,000. In 1917, however, the federal government took a long step toward accepting full responsibility for controlling floods and assumed two-thirds of the construction costs of control works, the other one-third of construction costs and rights of way and maintenance being left to local districts. Under the Flood Control Act of 1917, and the further legislation of 1923, the federal government has appropriated in the last ten years over \$86,000,000 for flood control works whereas local levee boards have spent about \$17,000,000.

#### SOLE FEDERAL RESPONSIBILITY

The history of the relationship between the federal government and the local districts indicates clearly a growing appreciation of the need of sole federal responsibility. Levee districts and bordering states should not be called on to pay all or part of works that are clearly a national responsibility. Such a principle is seldom applied to harbor works, locks, or dams, or in many instances to highways, which are constructed under the commerce clause of the constitution. It is just as fallacious to attempt to protect the heart of our country from floods by placing the duties both financial and protective upon the bordering districts as it would be to place the protection of our national boundary upon the boundary and coast states, or to call upon the ports of our nation to stand the expense of their navigation improvements.

The committee found that the present arrangement, which calls for local contributions and maintenance, results in a divided responsibility, and is destructive of success in planning, constructing, and maintaining the works necessary for flood control. The federal government in assuming its responsibility for the development of adequate flood control works should not have to deal with the local influences which grow out of this contribution system. Finally, in the words of one member of the committee, "It is a condition and not a theory" which confronts the nation in dealing with this flood control problem. Many of the levee districts are unable to do their part in maintaining the system as it exists today, a system which is obviously inadequate. Clearly they cannot furnish greater contributions to the enlarged program of construction which now faces the nation. The entire project cannot be permitted to lag because of the inability of any of the units to contribute.

The committee has had before it proposals that the federal government should enter into agreements with the affected districts looking to contributions in later years. Prec-



edent is against this principle as applied to works of a national character, and we believe it to be unsound.

In view of the universal demand for unified control and undivided responsibility in meeting this national problem for flood control on the Mississippi River, the local and state governments should not be called upon for further contributions, which, in view of the enlarged expenditures required, would be a small proportion of the whole, and would tend to interfere with the proper discharge of the federal government of its obligations to deal effectively with this problem in a national way.

#### RECOMMENDATIONS

*The federal government should hereafter pay the entire cost of constructing and maintaining works necessary to control floods of the lower Mississippi River. (For the purpose of this report, lower Mississippi means from Cairo to the Gulf.)*

*The federal government should assume the sole responsibility for locating, constructing and maintaining such works.*

As a result of its studies the committee is forced to conclude that the reason why the Mississippi River is still uncontrolled is a weak financial plan and inadequate and divided administration, and not inability of the nation's engineers to develop adequate plans. Unfortunately thus far the problem put up to the engineers has not been, "What levee will you build to safeguard the country behind it, and what will it cost?" The engineer has been given a certain sum of money to be expended in a given district and told to make it go as far as possible.

#### APPROPRIATIONS

That any plan of flood protection which may be adopted may be carried forward in the most economic and efficient manner, the rate at which appropriations may be expected must be definite. The first years of carrying into effect the project finally adopted will naturally call for sums less than in the later years when the organization has been fully perfected. Statements unfortunately have been made that enormous sums of money will be required immediately to deal with this project. Undoubtedly in the aggregate large sums will be required, but expenditures must necessarily be spread over a period of years, and certainly the amounts required for construction during the next year or two will in no way cast a burden upon the Treasury or interfere with the government's fiscal policies.

Inadequate appropriations in the past have materially delayed the carrying out of a systematic plan of protection. They are sufficient reason for insisting upon a proper financial scheme at this time. What the final cost of the project now being designed by the Mississippi River Commission and the Army engineers will be, can be only approximated at this time. The cost of this plan, or some modification, is not an issue. Competent authorities assure us, and we confidently believe, that the expense, though large, is one the nation can well afford to pay. Possible variations in the total figures are unimportant. The job must be done. It must be done as rapidly as the organizations for doing it and the detailed plans for the work can be perfected, after the project itself has once received national approval.

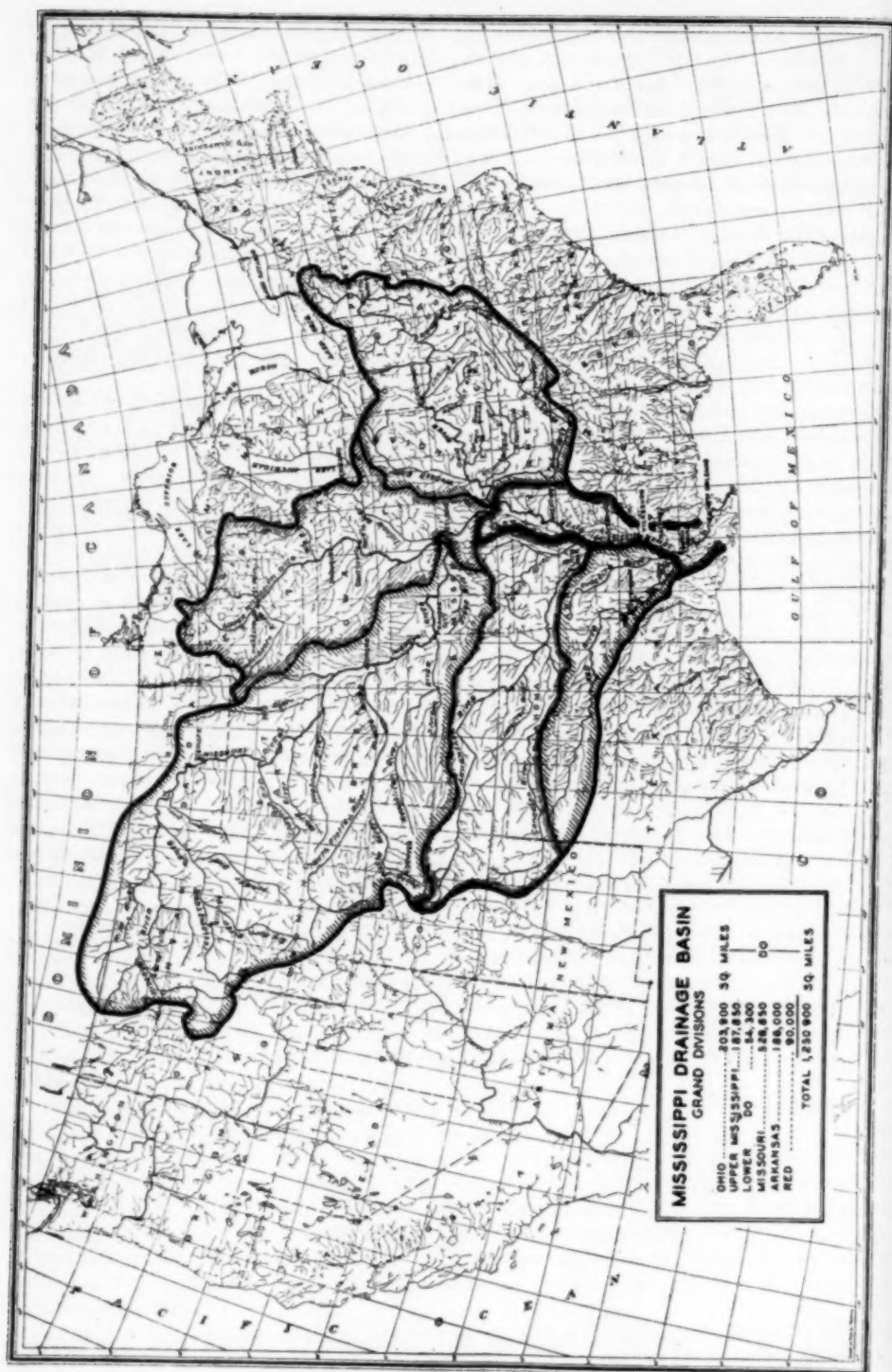
The necessary money must be available as needed. Conditions in the past may have justified the course which the federal government has pursued. On this point no comment need be made. We must accept the past as it is and profit by the experience gained. To permit this periodical destruction to continue, would be not only an indictment of our patriotism and wisdom, but an unescapable indication that we are unwilling to use our present vast national wealth and our administrative and engineering ability to remove this menace from the heart of our country. We, therefore, recommend that, *there should be an adequate appropriation to insure efficient, continuous and economic work, the funds to be made available as needed.*

In attacking this great national problem in which the federal government is to assume sole responsibility for its solution, and is to pay the entire cost of the project, the project

itself must be definitely conceived and set apart from all other domestic problems. It must be singled out and the solution considered and financed free from any relationship with other national or local problems. This is necessary because of the nation's interest in a complete and permanent solution. Such a solution can have nothing less than the support of the whole country. It must have particularly the support and judgment of all business interests. These cannot be divided, nor can they be considered in any way as related to similar developments elsewhere. This nation built the Panama Canal under just such circumstances, and in some respects this project is a more important one than building the Panama Canal. That project was a definite and entirely separate undertaking by the federal government. In such manner should the government attack the problem of flood control in the Mississippi River. It must not be entangled with any local conditions or limitations, financial, physical, or political. Neither should it be tied in with internal developments elsewhere within the country. The control of the Mississippi River floods is now more than ever before our greatest domestic problem. Legislation should deal with it singly, and free from other projects.

The committee had presented to it suggestions for extending flood control to tributaries of the lower Mississippi River and it has considered plans on a much larger basis involving the entire Mississippi River watershed; but it has always been forced to return to the important problem facing the main-trunk system of the lower Mississippi River. So long as the system of flood prevention in the lower region remains incomplete, this region requires first attention. The government is already prosecuting a study of the problems of tributary streams under an appropriation by Congress made for that purpose. The committee therefore makes no recommendation on this subject, pending that investigation.

We have recommended that sole responsibility for constructing the works to control floods be placed upon the federal government and the payment of the entire cost by the federal government in order to fortify this responsibility. It is equally important that the plan of administration should be centralized. As stated before, the project is likely to be more extensive than the Panama Canal and we may well take a leaf from the nation's experience with that great project. There should be a carefully formed organization adapted to carry on and complete a project of such proportions, vested with ample power for the necessary research by way of preparation for the adoption of its plans, and for carrying out the work, and with full discretion in all matters of engineering, operation and maintenance. We, therefore, recommend that, *flood control of the Mississippi River is a work of such magnitude and urgency that it should be dealt with in legislation and administration upon its own merits, separate and distinct from any other undertaking.*



# The Plan<sup>1</sup> for Flood Control of the Mississippi River in Its Alluvial Valley

Presented to the Secretary of War and by Him to Congress

By MAJOR GENERAL EDGAR JADWIN

Chief of Engineers

I HAVE the honor to submit the following project for the flood control of the Mississippi River in its alluvial valley.

The plan is a comprehensive one, providing for the maximum flood predicted as possible, and for future expansion to meet changing conditions. It includes a spillway above New Orleans, diversion floodways in the Atchafalaya and Tensas Basins, a river bank floodway from Cairo, Illinois, to New Madrid, Missouri, together with strengthening and a moderate raising of existing levees. It is designed to prevent any material increase in flood stages. Channel stabilization and navigation improvement are included. Exclusive of rights of way, incidental drainage works, and damages, if any, recommended to be borne by local authorities, the estimated cost of flood control works is \$185,400,000, and of channel stabilization and mapping \$111,000,000; a total of \$296,400,000. The distribution of cost must be determined by law. The suggestion is made that a distribution by which the cost of flood control works in general is borne 80 per cent by the Federal Government and 20 per cent by the Valley States, and the entire cost of channel stabilization is borne by the United States, would accord with the fiscal policy of the President and the precedents established by Congress.

<sup>1</sup> This is a copy of that part of this report in which the plan is presented.—*The Editor.*

The reorganization of the Mississippi River Commission, Federal control over structures within natural floodways, and the comprehensive mapping of the alluvial valley are also recommended. Flood control of tributaries will be reported upon after the completion of surveys already authorized by Congress.

The control of Mississippi floods by reservoirs is shown to be too costly to warrant their construction. Their development for local benefits is discussed. Other suggested schemes, including levees of sufficient height to contain the maximum possible flood, are discussed, but found inadvisable.

## ESSENTIAL FEATURES

The recommended plan fundamentally differs from the present project in that it limits the amount of flood water carried in the main river to its safe capacity and sends the surplus water through lateral floodways. Its essential features and their functions are:

Floodways from Cairo to New Madrid, from the Arkansas River through the Tensas Basin in the Red River, and from the Red through the Atchafalaya Basin to the Gulf of Mexico. These will relieve the main channel of the water it cannot carry and lower the floods to stages at which the levees can carry them.

A controlled spillway to hold the levels down to safe stages at and near New Orleans.



Local setting back of the levees in the main river at bottle necks to increase its carrying capacity and reduce its flood heights.

Greater protection against crevasses by strengthening the levee by reducing flood heights through the increased widths of channel afforded by floodways, spillways and setbacks, and by moderately raising the levees where needed to meet predicted flood stages.

The progressive revetment of caving banks to protect the foundation of the levees and to stabilize the river both for flood control and navigation.

Improved navigation channels for river traffic, not less than 300 feet wide and 9 feet deep, to be obtained by dredging and draining works where necessary between Cairo and New Orleans.

The estimated construction cost of the complete plan is \$296,400,000, and it can be advantageously executed in approximately ten years.

The project recommended gives the maximum of results for the minimum of cost. It recognizes the interests and protects the rights of those who will be chiefly benefited and of the taxpayers who furnish the funds. Complete flood control embodying the cheapest practicable reservoir system would be much more expensive.

The plan heretofore pursued has been the construction of levees high enough and strong enough to confine all of the flood waters within the river channels. The levees that have been constructed are not sufficiently high for such floods as are now predicted. The cost of raising and strengthening them sufficiently to carry extreme floods would greatly exceed the cost of the plan proposed. Furthermore, the extent of the disaster which follows a crevasse

increases greatly as the flood is forced to higher stages by confinement wholly within the levee system. The loss of life and property in the recent great flood in the alluvial valley followed the breaking of the levees which reclaimed the land for the use of man. This reclamation had been pushed so far that insufficient room was left in the river for the passage of the unprecedented volume of flood water. The levees must be strengthened, but a halt must be called on further material increase in their heights and the consequent threat to the inhabitants of the areas they are built to protect.

Man must not try to restrict the Mississippi River too much in extreme floods. The river will break any plan which does this. It must have the room it needs, and to accord with its nature must have the extra room laterally. In its original state the river had only one low water channel until it reached the flat land near the Gulf, but in flood it overflowed an area 50 miles wide, which is really its natural flood bed. The water which cannot be carried in the main channel with the levee at reasonable height must be diverted and carried laterally. Some additional capacity can be obtained in the main river by local setbacks of the levees. As a general setback is not practicable the remainder must be supplied by floodways paralleling the general course of the river.

The plan recommended provides the requisite space for the passage of floods, and levees of adequate strength to withstand them, so that should a flood recur of the magnitude of the flood just experienced, the maximum of record, it would be passed out to the Gulf without danger to life in the alluvial valley, and without damage to property except in the floodways allotted for its passage. Controlling side levees limit the area of the floodways, and protect



land not in the floodways where such protection justifies its cost.

Should Divine Providence ever send a flood of the maximum predicted by meteorological and flood experts as a remote probability, but not beyond the bounds of ultimate possibility, the floodways provided in the plan are still normally adequate for its passage without having its predicted heights exceed those of the strengthened levees. The plan is designed to be both simple and comprehensive, flexible and adequate to prevent a calamity such as that of 1927 from happening again as the result of any flood past or predicted. It is capable of modification or expansion, if desirable, to further accommodate an increasing population and its property.

#### FLOOD CONTROL OF TRIBUTARIES

Plans for the flood control of the tributaries will be developed as funds become available in accordance with an act passed at the last session of Congress. It is impracticable to present such plans at this time, because of lack of data and time. Congress recognized the need for further data when at its last session it enacted a law in the River and Harbor Act, approved January 21, 1927, authorizing and directing surveys by the Corps of Engineers of a large number of rivers, including the tributaries of the Mississippi, to determine the best use of their water resources. Flood control, power, irrigation, drainage, navigation and water supply must all be considered. This act was designed to promote the harmonious and coördinate development of all our water resources. Work on these surveys will require several years and will be expedited as funds are made available in future appropriation bills. Much work which has been done in arriving at the present alluvial valley project, particularly that done in the

study of reservoirs, will be of value when the tributary studies are undertaken. Many reservoirs on the tributaries which would be of little help to the Mississippi will be of great value in the control of floods on the tributaries as well as for other uses.

For the above reasons, only the lower courses of such tributaries as are directly connected with the flood control of the Mississippi in the alluvial valley are included in the plan herein. The other parts of the tributaries will be reported on as soon as practicable as contemplated by the Act of Congress referred to above.

#### DESCRIPTION OF PLAN FOR FLOOD CONTROL OF ALLUVIAL VALLEY

The details of the plan by which the surplus water will be carried with safety vary in different parts of the river. The alluvial valley of the river may be considered in three principal sections; the northern, comprising the St. Francis Basin on the west side of the river; the middle, including the Yazoo Basin on the east, and the Tensas Basin on the west, running on the east from near Memphis to Vicksburg and on the west from the Arkansas River to the Red River; and the southern, or Louisiana Section, from the Red River to the Gulf of Mexico.

The portion of the alluvial valley from Cape Girardeau, the northern limit of the alluvial valley, to Cairo, can be protected by a slight increase in the size of the levees. The serious problem begins at Cairo at the confluence of the Ohio and the Mississippi. From here to New Madrid the main levee on the west bank chokes the river unduly and should be set back sufficiently to lower the head of water at Cairo by 6 feet in an extreme flood. The existing river bank levee will be retained, but lowered 5 feet. The floodway between the new and the old

levees will be capable of cultivation at all times excepting in floods greater than that of 1922.

An estimate is included for removing part of the dike on the Tiptonville Ridge to reduce the backwater area at the mouth of St. Johns Bayou to the minimum practicable.

From New Madrid south to the mouth of the Arkansas, the levees will be raised moderately. Local setbacks will be made below Helena and at other bottlenecks where necessary to restore greater cross sections in the main river. These modified works are designed to carry the highest predicted flood, except that it may be found expedient not to raise the levees opposite the backwater areas of the St. Francis and White Rivers. In this event, if a possible superflood should come, it may cause a crevasse in the levees at these points, increasing somewhat the height and acreage of backwater area, but doing comparatively little harm.

From the mouth of the Arkansas to the Old River, at the mouth of the Red, extreme floods cannot be carried between levees of the Mississippi without dangerous increase in their heights. A floodway for excess floods is provided down the Boeuf River, on the west side of the river. Excess water cannot be carried through the section on the east side, since it would be forced back into the main river by the high lands on the east bank below Vicksburg and have to be carried thence for 160 miles between the main river levees to the mouth of the Red River. The entrance to the floodway is closed by a safety plug section of the levee, at present grade, which is located at Cypress Creek, near the mouth of the Arkansas. To ensure their safety until this section opens, the levees of the Mississippi, from the Arkansas to the Red, will be raised about 3 feet. To prevent flood waters

from entering the Tensas Basin, except into the floodway during high floods, the levees on the south side of the Arkansas will be strengthened and raised about 3 feet as far upstream as necessary.

The section at the head of the floodway will protect the land within the floodway levees against any flood up to one of the magnitude of the 1922 flood. A flood of a magnitude somewhere between that of 1922 and of 1927 will break it, turning the excess water down the floodway, which will carry it safely to the backwater area at the mouth of the Red River.

Below the Red River, setbacks of the levees will be made at critical places in the main river, to insure the better discharge of flood waters, but the carrying capacity of the main river cannot be increased materially without unwarranted hazard to life and property in the state of Louisiana. At the city of New Orleans, an increase in levee height is considered unsafe, aside from the great cost of raising the levees and the wharves built upon them. To afford proper protection to New Orleans, with its population of nearly half a million and property value of over a billion dollars, a special floodway upstream from the city is essential. The most practicable location is on the east side of the river, discharging into Lake Pontchartrain. A controlled spillway at Bonnet Carré will limit the discharge through this floodway to that necessary for the protection of the city.

At high floods it is also necessary to divert down the Atchafalaya Basin the flood waters in excess of the discharge capacity between the levees of the Mississippi. This is accomplished by strengthening and raising the levees on the main river 3 feet for the necessary distance to assure their safety until levees at the head of the Atchafalaya

Basin open. The levees on the south bank of the Red River will be strengthened and raised sufficiently to keep flood waters from entering the Atchafalaya Basin except in the floodway, through the relief or fuse plug levees at the head of the floodway. Back levees are to be constructed on both sides of the Atchafalaya Basin for the major part of its length, to enclose the Atchafalaya floodway. Funds are included in the estimate for the extension of these levees to the south, to limit the overflow in the lower part of the Basin.

Existing levees on the Atchafalaya River will be strengthened and their grade adjusted so that the productive capacity of such parts of the floodway as are not already swamp land will be retained during any flood of record of a less magnitude than that of 1927.

The plan includes an extension of revetment of the banks of the river, to reduce the danger of attacks on the foundations of levees and their destruction by caving banks, thereby to further reduce the possibility of crevasses and to stabilize the position of the river in order that contraction or regulation works may be provided, to assist in securing and holding the low water channels needed for carrying the commerce of the valley in low water as well as in high.

The area in the alluvial valley that would be flooded by Mississippi River water if there were no protecting works is approximately 30,000 square miles. Under the plan recommended, barring accident, approximately 20,550 square miles will be protected annually. The remaining 9450 square miles, of which approximately 3340 square miles is cleared land, will be protected on an average of from 2 years in 3 to 14 years in 15, depending upon its location. The remaining 6110 square miles are swamp and timber land which is not injured by flood.

The estimated cost of \$296,400,000 for the construction of flood control and navigation work does not include the costs of rights of way nor possible damage to structures which have invaded the natural flood bed of the river. It is expected that these, if any of them are legal and proper, will be borne by the states or other local interests who will in general be greatly benefited by the execution of the plan.

#### ECONOMIC NECESSITY AND LOCAL COÖPERATION

As directed by the law relating to reports by the Department, I submit a statement as to the general and local benefits of the plan and the local coöperation that should be required on account of local benefits. The question must be viewed from the standpoint not only of those in the valley needing flood protection, but also of the taxpayers in other parts of the country, including the regions from which the flood waters come, who suffer indirectly from flood disasters, and on whom the bulk of the burden of Federal expenditure must fall.

Several estimates of different well-protected parts of the delta valley result in an average price per acre of \$224 when towns and all property, such as houses, roads, railroads, land, etc., are included. The total area of the valley originally subject to overflow is 29,790 square miles, or 19,065,600 acres, 12,000,000 acres of which is usable. This 12,000,000 acres at \$224 per acre is worth about \$2,688,000,000. Adding the probable value of New Orleans would bring this sum up to about \$3,500,000,000. Movable property added would make it something like \$5,000,000,000.

The value and population behind the levees are increasing all the time. It has been estimated that damages from the 1927 flood were over \$200,000,000.

The plan for river control contemplates spending about \$3,000,000,000, or about one-sixteenth of the value estimated above. On the basis of 12,000,000 acres of usable land, this is an average expenditure of about \$25 per acre, but it must be remembered that this includes protection to cities, towns, etc.

The cost of the project is unquestionably justified. It will prevent a repetition of the widespread disaster, human suffering, dislocation of the economic life of the valley, interruption of interstate commerce, and the effect on the general welfare of the nation, that attended the recent flood. The expenditure would be justified even though such a flood occurs but once in 150 years. It will prevent the less extensive flood disasters that are likely to occur at much more frequent intervals. The protection afforded to the cities back of the levees in the valley against a flood even greatly exceeding that just past is especially justifiable from a humanitarian standpoint, since an unexpected break in the levees at these places would probably result in serious loss of life and might be an unparalleled catastrophe.

The estimated cost of \$296,400,000 for the construction of flood control and navigation works does not include the costs of rights of way for flood control works, the cost of any drainage works required therewith nor the cost of any flowage rights that may be required, nor damages, if any, resulting from the execution of the plan. No questions of rights of way or damages arise in connection with the navigation works. Local interests should in the future as in the past provide all rights of way for flood control structures. They best can obtain the land at a fair value, and vexing questions as to Federal ownership, administration or police of the narrow strips of land will be eliminated.

Their land is enhanced in value by the works. Tax collections show that the land in the Upper Yazoo Basin has ten times the value that it had before it was leveed. The United States ought not to buy a part of the land to enhance the value of the rest.

Such drainage works as will be required in connection with new interior levee construction are of direct benefit to the lands affected and their cost should be borne locally.

It is a fundamental principle that no damages lie against either Federal or State Government, or local agencies, on account of an accidental crevasse in the levees. The plan has been drawn to reduce to a minimum the damage to lands and structures resulting from the flow at high floods through the floodways. All property affected lies in the natural high-water bed of the river. Much of this land was transferred to the states by the Swamp Act approved September 28, 1850. The purpose of this Act was to enable the states to construct the necessary levees and drains to reclaim the swamp and overflowed lands therein. The principle involved was not new, as the early French grants in the lower valley contained a proviso requiring the grantee to construct and maintain a levee line along the river front of his property. In the state of Louisiana, this old servitude has been transferred by the state to the levee district in which the land is located. Whether or not the servitude of flooding was transferred to private owners when the land was sold, the servitude existed when the land was granted to the states without cost. It should not now be paid for by the Federal Government. Moreover, the lands, with some exceptions, will have the same protection as is afforded by the present levee system, a protection provided partly at the expense of the Federal Government.



The exceptions are the lands in the Bonnet Carré floodway and in the setback floodway from Bird's Point to New Madrid. The acquisition of flowage rights by the state or local interests may be necessary in these cases. In any case, the lands should remain in private ownership in order that their productive capacity may be fully availed of. The United States does not in general own the bed of navigable streams; much less need it own land flooded only at long intervals. Damages, if any, which may be found legal

procedure requisite to the enactment of the legislation would unduly delay the initiation of work of far-reaching benefit, particularly if such work is essential to the protection of another state which has fulfilled these conditions.

The present Flood Central Act provides that local interests shall pay one-third the cost of levee construction. The following table shows the proportions of the cost of levees actually borne in the past by the Federal Government and local authorities:

AMOUNTS EXPENDED BY THE UNITED STATES GOVERNMENT IN THE CONSTRUCTION OF LEVEES  
AND THE AMOUNTS EXPENDED BY STATES, LEVEE DISTRICTS, AND  
COMMUNITIES INTERESTED, FROM 1882 TO DECEMBER 31, 1926,  
COVERING COST OF YARDAGE PLACED, RIGHTS OF WAY,  
INTEREST, ENGINEERING EXPENSES, REPAIR  
WORK, HIGH-WATER EXPENSES,  
CREVASSE CLOSING, ETC.

M. R. C. Districts	Expended by United States from Govern- ment Funds	Expended by United States from Contrib- uted Funds	Expended by State and Local Organizations	Total
Northern.....	\$3,127,533.49	\$1,083,857.69	\$9,913,110.91	\$14,127,502.09
First and Second.....	19,796,161.78	4,348,420.82	42,766,497.05	66,911,079.65
Third.....	27,614,208.84	5,852,103.37	34,782,460.96	68,248,773.17
Fourth.....	20,552,089.47	3,773,898.32	64,488,106.33	88,814,094.12
Total.....	\$71,089,993.58 30%	\$15,058,280.20 7%	\$151,953,175.25 63%	\$238,101,449.03

and proper as a consequence of the plan should be met by the states, since these will be directly benefited by the works.

The project should be authorized subject to the condition that, except when specially authorized by the Secretary of War, upon the recommendation of the Chief of Engineers, no Federal funds shall be expended upon the part of the project within any state until that state has accepted by appropriate legislation these conditions and responsibilities. The saving exception is suggested to cover the case where the

In addition to meeting the costs shown in the table, the inhabitants of the valley have been subject to recurring flood damage. The direct damages suffered from the 1927 flood are estimated by the Mississippi Flood Control Association to have been \$236,334,414.06.

The table clearly shows that the people of the valley have borne much the greater part of the cost of flood protection, although the United States has given substantial aid. The local participation has furthered the keen interest of each locality in the proper

execution of the work. It has afforded a check on pressure for the execution of works not economically justified.

The division of cost has led to some division of control. The enlargement of levees affecting large areas has been delayed, in some cases, by the failure of a levee district to furnish its share of the cost. It is doubtful whether these disadvantages have counterbalanced the advantage of a local proprietary interest in the works.

The comprehensive plan now presented does not include the protection of areas whose reclamation is not economically justified, but contemplates that such areas be left open for temporary storage and the discharge of floods. If no local contribution is required, the law and the administration of this project must be relied on to prevent the construction of works not economically justified. If a contribution, small in comparison with the cost of work already done and to be done, will assist materially in retaining the proprietary interest and watchfulness of local authorities, it would seem to be justified.

In view of the national aspect of the flood control problem from the standpoint both of the cause and of the effects of the floods, and in view of the large sums spent in the past by the people of the valley for flood protection, the sacrifices they have made in meeting their allotments, the great losses suffered in the past flood, and the larger expenditures now required, it is believed that the United States should bear a larger proportion of the cost of construction than in the past, and that of the states or local interests be as small as consistent with the results desired. While the proportion must be determined in the wisdom of the President and Congress, a division by which the United States bear 80 per cent and local interests 20 per cent of the cost of

levee construction and control works in general; and by which the United States bear 50 per cent and local interests 50 per cent of the cost of the special ring levees proposed at Morgan City, Melville, Simmesport and Arkansas City, would be in general accord with the existing policy of the President and the precedents established by Congress.

The expenditure for flood control structures proper, required in the comprehensive plan herein recommended, exclusive of navigation works, revetments, etc., is \$185,400,000.

On the basis suggested, the total construction costs would be divided as follows:

BY THE UNITED STATES	
80% of general levee and control works.....	\$147,360,000
50% of special protection work.....	600,000
100% of works for channel stabilization and mapping navigation.....	111,000,000
Total.....	\$258,960,000
BY LOCAL INTERESTS	
20% of general levee and control works.....	\$36,840,000
50% of special protection works.....	600,000
Total.....	\$37,440,000

The local interests are also expected, under the project, to furnish rights of way, and protect the United States against charges for flowage easements and damages.

While \$37,440,000 is small in comparison with the amount to be spent by the United States and with the amounts already spent by the people of the valley, it must be remembered that those people still owe considerable sums on their bonds on which the money spent was raised. Some of the levee districts are also near the limit of their bonding power under present state law and also near the limit of their credit. However, it is not equally clear that

this expenditure, spread over a ten-year period among four or more states, would constitute an unreasonable burden, on the states themselves, in view of the increased taxable values which will result from the improvement.

#### SUMMARY OF PROJECT

I recommend the adoption and authorization of a comprehensive project for the flood control of the Mississippi River in its alluvial valley and its improvement from the Head of the Passes to the Ohio River as set forth in this document, to be prosecuted under the direction of the Secretary of War and the supervision of the Chief of Engineers; the project to include the floodways, spillways, levees, channel stabilization, mapping, etc., hereinbefore recommended, with such modifications thereof as in the discretion of the Secretary of War and Chief of Engineers may be advisable, and the maintenance of a navigation channel from Cairo to New Orleans not less than 300 feet in width and 9 feet in depth, all at an estimated initial cost of \$296,400,000 with \$6,000,000 annually for maintenance after completion of project, with such distribution of costs as may be specified by law after considering the statements on economic necessity and local cooperation in paragraphs 25 to 42 inclusive. Its adoption should be made subject to the provision that, except when authorized by the Secretary of War upon the recommendation of the Chief of Engineers, no funds appropriated by Congress for the execution of the project shall be expended on works within a state until that state by appropriate legislation

(a) Has undertaken to provide without cost to the United States and when required the rights of way for all levee structures, and such drainage works as may be made necessary by new levee construction.

(b) Has consented to the maintenance of the levee at the head of floodways within the state at the grades and cross sections necessary in the opinion of the Chief of Engineers for the security of the levee system and the lands protected thereby.

(c) Has agreed to hold and save the United States free from all damage claims resulting from the construction of the project; and to maintain all flood control works after their completion, except controlling and regulating spillway structures.

I recommend that the Secretary of War be authorized to continue in his discretion, and under the supervision of the Chief of Engineers, the prosecution of such works for the flood control of the Mississippi River as have heretofore been authorized and are not included in the project herein recommended; to expend, in an emergency, funds appropriated for the execution of the project on the maintenance of any levee, when it is demonstrated to his satisfaction that the levee cannot be adequately maintained by local interests; and to secure the assistance, whenever practicable, of the United States Geological Survey, the Coast and Geodetic Survey or other mapping agencies of the Government in the preparation of maps required in furtherance of the project, and to allot funds therefor to them from funds appropriated for flood control work.

I further recommend that legislation be enacted:

(a) Prohibiting any obstruction not affirmatively authorized by Congress to the flood discharge capacity of the alluvial valley of the Mississippi River below Cape Girardeau, and providing that it shall not be lawful to build or commence the building of any levee or other structure in said alluvial valley, or in any

floodway provided therein unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War.

- (b) Providing that the penalties and procedure applicable to violations of the laws for the protection and preservation of the navigable waters of the United States, enacted in Sections 12 and 17 of the River and Harbor Act of March 3, 1899, shall apply to violations of the above provision of law.

- (c) Providing that existing laws relating to the acquisition of lands, easements on rights of way needed for a work of river and harbor improvement shall be applicable to the acquisition of lands, easements or rights of way for flood control works.

- (d) Amending Sections 3 and 4 of the Act of June 28, 1879, constituting the Mississippi River Commission; to provide that it shall be the duty of said Commission to advise on all questions relating to the improvement of navigation on the Mississippi River and the prevention of destructive floods which may be referred to the Commission by the President of the Commission or higher authority, and to provide that the President of the Mississippi River Commission shall have the qualifications now prescribed by law for the Assistant Chief of Engineers, and shall receive the rank, pay and allowances of a Brigadier General of Engineers while actually assigned to such duty by competent orders.



# What Forests Can Do for the Mississippi River

By E. A. SHERMAN

Associate Forester, U. S. Forest Service

IN 1879 the Government of the United States recognized that the control of the periodic floods of the Mississippi River was a national problem. To meet this problem Congress created the Mississippi River Commission, consisting of seven members, three of whom are selected from the Corps of Engineers, United States Army, one from the Coast and Geodetic Survey, and three from civil life. This Commission operates under the direction of the Secretary of War and the Chief of Engineers. Its integrity and devotion to duty have never been questioned.

This Commission after a careful study developed a plan for controlling the floods by means of a system of levees and, with the approval of Congress, work thereon started in 1882. Up to June 30, 1926, there had been expended in the furtherance of this plan a total of \$174,469,931.06 on the Mississippi River, \$81,686,285.56, including \$16,689,146.66 contributed by local interests, being for flood control.

In his report for the year ending June 30, 1926, the Chief of Engineers, United States Army (page 1793), said:

*Effect of Improvement.*—It may be stated in a general way the improvement is providing a safe and adequate channel for navigation and is now in condition to prevent the destructive effect of floods.

Then came the flood of 1927, the greatest physical disaster in American history. Of the 30,000 square miles threatened with inundation, the levees successfully protected 12,000 square miles having a larger percentage of

cultivated land than the 18,000 square miles flooded. Nevertheless the resulting loss of property was great and fell upon a people already heavily debt-burdened for the construction of costly flood defense works. Loss of human life was providentially small, but the suffering, misery, and despair was such as is only known by a people who have to flee their homes before the advancing hosts of an invading army. In this case the invading army was water instead of armed men. The element of personal conflict was absent but in its stead was an impersonal relentless element that covered all things, penetrated everywhere, and when it withdrew left behind only death, filth, ruin and decay.

These facts are recited, not with the thought of charging delinquency to the Commission. Omnipotence cannot be expected of any human agency. Rather are they recalled as proof that the problem is one of controlling great natural forces and that no system of protection that man erects can have factors of safety so great that assistance from other sources should be ignored. Doubtless the Commission itself would be the first to subscribe to such a conclusion. Probably there is nowhere in the country today any considerable sentiment for "levees only," but even the writer of this article acknowledges a conviction favoring "levees first."

In the past there has probably been a tendency to overstate the case both for and against forests as a factor in flood control. Let it, therefore, be understood at the outset that the writer does not advocate forests as a substi-

tute for levees. Levees are necessary now, always have been necessary, and certainly will be necessary for generations to come. They should be constructed high enough and strong enough to control the greatest flood within the range of reasonable probability. This country is rich enough and resourceful enough to construct a system of levees of that kind, and the writer would not advocate diverting from such a project a single dollar necessary to its successful completion.

The problem of providing immediate protection to the region threatened by flood waters can only be solved by the construction engineer whose field of direct responsibility is the protection of a limited area of about 30,000 square miles, formerly used by the Mississippi River periodically as part of a great flood channel, but now taken over by man for agricultural and other purposes. At the same time there is a great problem of land use which also has a direct bearing on the regimen of the Mississippi. It involves the entire area of about 1,225,000 square miles which contributes its surplus waters to that stream. The use which is made of any part of that vast area directly affects runoff and runoff makes floods.

One of the most common forms of use to which land is put is the growing of forests. Generally speaking, the lands so used are those having the most direct bearing on floods. They are lands too rough and steep for cultivation and the high mountain lands which receive a heavier precipitation than the plains lands. Forests of swamp or bottom type and on level sandy soils which absorb the heaviest rainfall without washing are exceptions to the general rule.

Originally about 60 per cent of the Mississippi basin was treeless and 40 per cent forest. In De Soto's time the river was subject to floods. The

Missouri brought down its great loads of silt from the "Badlands" and the Arkansas brought its burden of soil from "The Breaks" at the edge of the "Staked Plains," and each spring the flood waters deposited a layer of silt over the 30,000 square miles which we now wish to permanently reclaim.

Since De Soto's day the proportion of forest land in the valley has been cut to 20 per cent, or about 250,000 square miles. It is idle to expect that the proper use of this relatively small proportion of the entire watershed could prevent floods. Upon the other hand it is equally absurd to say that the use of so great an area has no bearing on resulting floods and runoff. Avoiding extremes in either case, one may expect provisions for the efficient protection and management of the forests now existing on the watershed and the replanting of lands which are now washing badly and should never have been cleared, will be included in future plans for Mississippi flood control, and that such use of land will add materially to the security and permanent usefulness of the supplementary levees and other necessary engineering structures.

For a clear understanding of the influence of forests on streamflow regulation one must take into consideration certain laws of physics governing the power of running water. First, the erosive or abrading power of a stream varies as the square of its velocity. For example, if the velocity of the stream is increased ten times its erosive power is increased one hundred times. Second, the transporting power of water varies as the sixth power of its velocity. For example, if the velocity of a stream is increased ten times, its transporting power is increased one million times. A current two miles an hour will move along its channel fragments of stone the size of a hen's egg, weighing about three ounces, while a

torrent of twenty miles an hour will carry boulders weighing one hundred tons.

It is a self-evident fact that water falling on steep lands tends to rapid runoff. The laws just cited show that erosion is tremendously increased by rapidity of runoff. It follows that for any given type of soil the steepest lands are most subject to erosion. Therefore it is upon steep rough lands that forests as an erosion-preventive factor are most important.

Coincident with retarding erosion and runoff, forests also retain a considerable volume of moisture and increase the amount taken up by the soil. Not only is the earth protected from beating rainfall but the precipitation is broken up by the leaf canopy, and must either settle in the form of mist or reassemble on twigs and branches and slowly trickle to the ground. Also, if the forest has been protected from fire and excessive tramping of stock, the trickling moisture encounters a layer of humus composed of dead leaves and other vegetation which readily absorbs water amounting to several hundred times its weight.

A layer of humus four inches deep will easily retain and transmit to the soil one inch of rainfall. This statement is conservative. The immediate water storage capacity of such a forest may therefore be calculated as equivalent to 3630 cubic feet. The effect of increasing water storage on a single acre would hardly be noticeable on the smallest stream. The effect of even a million acres would scarcely be noticed in the volume of a great Mississippi flood. However, it is just as true of the Mississippi flood as it is of the smallest rivulet that its burden of liquid and solids is made up of little drops of water and little grains of land.

The total area of forest land and lands once forested but now unused and

bare of forest growth in the Mississippi drainage basin is 250,000 square miles. About 200,000 square miles of such forests and forest land is far from doing what it might to hold back flood waters and prevent erosion. Some lands are in fairly good shape; some very bad shape. To rate the present water holding capacity of any but the best of these lands at 50 per cent that of a well stocked, well protected forest is generous indeed. If we reforest the bare unused forest lands and protect the remaining forests, both old and young, from fires, and prevent overgrazing, this should on the average increase the layer of humus on 200,000 square miles by two inches. Such an increase means 1815 cubic feet of water storage by each acre of forest land so improved. Applied to 200,000 square miles such improved forest conditions would give an increased water storage capacity totalling 232,320,000,000 cubic feet, or the equivalent of the entire reported average flow of the Mississippi River at Quincy, Illinois, for a period of nearly thirty-seven days.

For the purpose of assisting in the regulation of streamflow on the Mississippi, dams have been constructed at the outlet of Lake Winnebigoishish and five other lakes at the headwaters of that river, thereby creating what is said to be the greatest water impounding system in the world. These six great storage reservoirs have a total impounding capacity of somewhat over ninety-five billion cubic feet. The forests of the valley can be made to store and regulate the flow of about two and a half times the total capacity of these great reservoirs over and above the present water storage service, while at the same time increasing their value and effectiveness for wood production, outdoor recreation, and other purposes. This will not prevent floods but will reduce them.

However, water storage is not the greatest service performed by forests in the direction of flood control. More important than water storage is their influence in preventing soil erosion, which after all is the problem most vital to the Mississippi Valley. Floods in the lower valley threaten periodically a region embracing a total of 30,000 square miles, but soil erosion is nibbling constantly at the fertility of the 1,225,000 square miles of watershed contributing to flood runoff.

The whole world knows that the Mississippi flood of 1927 temporarily inundated a total of about 18,000 square miles, much of it cultivated. But few know or care that because of soil erosion 1842 square miles of plowed land in four small tributary drainage units just east of the bottom lands in Mississippi was abandoned between 1920 and 1925. Combined, the four units had a gross area of only 13,336 square miles. The abandoned plowed land of the five year period was therefore over 13 per cent of the gross area. In one unit 50 per cent of the plowed land was abandoned within the two dates.

These cases are extreme examples of what is taking place in many parts of the Mississippi watershed. In the aggregate it is reasonably certain that a greater acreage of farm land has had its value for cultivation permanently destroyed by soil erosion during the past five years by floods on the Mississippi watershed than the gross area endangered by inundation from Cairo to the Gulf.

Undoubtedly more poverty and suffering have resulted from soil erosion than from floods, but it creates no thrilling spectacle, gets no newspaper headlines and no Red Cross relief. And yet the family that is driven from its home by gully washing is

a flood sufferer whose misery is no less acute because comparatively unknown.

Land with erodible soils having a slope so slight as  $3\frac{3}{4}$  per cent will under the ordinary rainfall conditions of the great agricultural sections of the Mississippi Valley lose on the average, either as bare or cultivated land, twenty-three tons of soil per acre annually. The cultivation of lands with a much greater gradient, even up to two or three times as great, is not uncommon, with erosion increasing at a greatly accelerated rate.

Silt in a stream not only increases its volume but also multiplies its power to destroy. It gives it an abrasive capacity not possessed by a clear stream. Forests are the best means of checking erosion. Streams originating in timber-covered hills are clear and pure.

Forests cannot remove from the Mississippi all its great burden of silt, amounting annually to somewhere between half a billion and a billion tons. They can, however, if maintained on steep lands largely reduce this silt burden as well as assisting in regulating the streamflow. Forests cannot prevent floods on the Mississippi, but can be made to materially increase the safety factor of levees and other protection works. Reforestation would also extend the periods of usefulness of such works. It is a self-evident fact that a balance must eventually be established and maintained between the amount of silt annually received by the river between the levees below Cairo and the amount discharged into the Gulf of Mexico. If the amount received greatly exceeds the amount discharged into the Gulf of Mexico, the day of flood destruction must come sooner or later. It is cheaper and better to keep rich soil on hillside slopes by growing forests than to per-



mit its accumulation in the river channel. This forests can do for the Mississippi River, while at the same time furnishing to the industrial popu-

lation of the valley a class of raw material which thus far in human history has been found essential to progress and prosperity.

# A Policy for the Mississippi

By ARTHUR E. MORGAN

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**I**N the course of the material growth of America we find, beginning about the middle of the last century, a development which is revolutionizing our civilization. It is the application to our practical problems of processes of exact and fundamental scientific analysis and synthesis, to replace the age-old methods of rule-of-thumb approximation. The searcher for ultimate beginnings may trace this process in America back to David Rittenhouse, who was described by Thomas Jefferson as the greatest mind of his age. As with a great river, there may have been many independent beginnings, all contributing to swell the main stream to a volume where it would affect our national life.

One of the early exponents of this new and revolutionizing spirit was James B. Francis of Massachusetts. About 1850, not satisfied with the crude methods then in use for the measurement of flowing water, he carried through the Lowell hydraulic experiments which became a model of clear, accurate engineering analysis.

## APPLICATION OF SCIENTIFIC METHODS TO ENGINEERING PROBLEMS

The spirit of Francis inspired the engineers of the Metropolitan Water Board, which was the agency for supplying water to Boston and its suburbs. Here, for perhaps the first time in America, we have an example of a great public engineering development carried out in a truly scientific spirit, with rigorous scientific analysis and design.

When the New York Board of Water Supply started on the great project of bringing water from the Catskills to New York City, the work at Boston was coming to completion, and Waldo Smith, Chief Engineer of the New York project, was able to get from Massachusetts some good men already well trained in large works of that particular type, to supplement those developed in New York. The work done under his direction stands out as one of the finest applications of scientific methods to engineering problems.

In 1913, when the writer undertook to organize the engineering forces of the Miami Valley flood control project in Ohio, the water supply development in New York was nearing completion, and he was able to secure some of the men who had grown up under the influence of this great tradition. But he was no longer limited to a single source. The spirit of thoroughgoing scientific analysis of engineering problems has taken root in many places, quite largely through the work of our technical schools and universities, and the fifty or more engineers of the Miami project, gathered together by combing the entire country for men of quality, were from a dozen or more distinct fields of training. The technical reports of the Miami Conservancy District constitute a monument to their scientific spirit, and are an effort to pass on to posterity the contributions they had received from the past.

Little by little the methods of thoroughgoing scientific analysis and synthesis are supplementing, enlarging

and perfecting the methods of the "practical" engineer which were based on first-hand experience and informal judgment or intuition. But the process is far from complete. Within a year the writer has been asked to pass on the plans of two great public water control projects in widely different regions, which show very little signs of being influenced by modern engineering methods.

In each case millions of dollars are being badly spent, and there is a blind fumbling about for a solution. The problems are too great to be solved by informal judgment based on everyday experience. They can only be well handled with clear rigorous scientific analysis, based on carefully collected data, and this method is as yet none too familiar to those in charge. In nearly all American engineering there is much scientific analysis of details, but it is a far cry from the rule-of-thumb work of a century ago to the modern projects where analysis is rigorous, thorough and all-inclusive, and where there is an adequate examination of every possibility. Very often we find the most conscientious and exact analysis of the details of design, while at the same time the main features are determined by guess, intuition or tradition.

#### RULE-OF-THUMB METHODS IN THE MISSISSIPPI PROJECT

But what has all this to do with the problem of the Mississippi? Just this, that the administration of the Mississippi furnishes the outstanding example in America of a great engineering project which still in its main outlines is being handled by rule-of-thumb methods. The problem is so vast and so complicated that it is impossible of economical mastery except by the most thoroughgoing, comprehensive and vigorous scientific analysis, and yet,

considering the problem as a whole, these methods never have been applied.

Perhaps the word "never" is not correctly used, for from 1855 to 1860 two Army engineers, Humphreys and Abbot, made a study of certain characteristics of the river which still stands as a masterpiece of engineering research. But there was no apostolic succession. There has been much desultory scientific study of details on the Mississippi, but no comprehensive and exhaustive analysis or synthesis.

A brief account of Mississippi flood control may help to an understanding of the situation. Along the Mississippi River, from Cairo at the southerly tip of Illinois, to New Orleans, a hundred miles from the Gulf, the banks of the river are higher than the lands farther back. The first farming was along these high banks. Slight overflows were frequent, while very heavy flooding happened only once in perhaps five or ten years, so it was possible for planters to save many of their crops by building little dykes or levees about their farms.

#### THE MISSISSIPPI RIVER COMMISSION

As time passed neighboring planters joined their levees together, then the several states passed laws for the organization of levee districts, with the power of taxation, and finally the planning and direction of the whole work was taken over by the Mississippi River Commission. The Commission was organized in 1879 by act of Congress. It is headed by an Army engineer who acts as its president, and its membership includes both Army engineers and civilians. Its agents along the river are Army engineers, who are assigned to various stations and are served by civilian assistants. The assignment of army engineers to these stations generally is for short

periods, until recently about two years at a station. The last position of an engineer assigned to the river might have been the administration of an Army post, or the maintenance of a harbor, so there has been small chance to develop special ability in river control. At first the functions of the Commission were advisory, but gradually, with increasing appropriations, its powers have increased.

Throughout this whole process there has been a gradual development of Mississippi control by the enlarging and coördinating of works already in existence. It has been a step by step process, always building the immediate future on the immediate past.

#### SUCCESSFUL PROTECTION OF THE UPPER YAZOO DISTRICT

A typical case will illustrate the methods used. The most successful of all flood control efforts along the Lower Mississippi are those of the Upper Yazoo Levee District. This district covers the territory from the north line of the State of Mississippi, just below Memphis, to a point perhaps a hundred miles south. The Yazoo Delta, which is the overflow area extending from the Mississippi River to the hills on the east, is one of the most fertile regions of America. It is the function of the Upper Yazoo Levee District to protect most of this area from Mississippi overflow by levees along the river.

About 50 years ago Major T. G. Dabney, a typical old-time Southern gentleman, became chief engineer of this district. He had good intelligence, a dominant personality, excellent political sense, and above all absolute integrity. In other levee districts the elected officials of the district employed the chief engineer. In the Upper Yazoo District Major Dabney was held in such complete

confidence by the public that he ruled like an autocrat. No elected official who thwarted his purposes could long hold office.

Money raised by taxes in the Upper Yazoo Levee District was spent for building levees, and not to pay political debts. Contractors got work on their merits, and not by favoritism. An influential planter might insist that the levee be built near the river edge where it would protect his field, but if that would put the levee near a caving bank, the planter's influence would count for nothing. The levee would be set back at a safe distance.

Major Dabney so thoroughly established his policies that since his death several years ago they have been continued. Chief among these policies was the rule that the levees of this district must always be two or three feet higher than those just across the river. Regardless of the size of the flood, the levees of the Upper Yazoo District remained intact because breaks on the other side would provide outlets for the swelling waters. They have held without a break for more than 30 years.

Three conditions made this program possible: First, the integrity, economy and long experience of Major Dabney made all resources count. Second, while the district across the river was recovering from disastrous floods the resources of the Upper Yazoo District were intact and available for building more levees. Third, and of almost controlling importance, the belt of land to be protected back of the Upper Yazoo levees was wider than in other districts, so that a greater number of acres was available for taxation to build each mile of levee.

#### WEAKNESSES OF THE OLD SYSTEM

Here we had the old system at its best. But it was a rule-of-thumb



system. Major Dabney did not know how much water might come down the Mississippi. He did not know how high his levees would have to be if all other levees should be as high as his. He did not know the silt-carrying capacity of the river nor the exact conditions under which disturbances of flow would take place. As to the feasibility of reservoir control, he was certain there was nothing in the idea, although he knew very little about the presence or absence of sites for such reservoirs, and, I believe, had never understood the principles on which they would best operate.

The writer once spent a month with Major Dabney, and found him to be a man of high intelligence, wide reading, and keen discrimination, but the modern method of rigorous, fundamental and comprehensive analysis was not his. He had never been introduced to it.

That same fundamental criticism holds against almost the entire administration of the Mississippi River. There has been a vast gathering of data, and with reference to many details there has been excellent scientific analysis. But taking the problem in its entirety it has been handled by observance of traditional dogmas, arbitrary rules and unproven axioms. The immediate future has been guided by the immediate past. No one comprehended and mastered the whole problem of the river. Comprehension of the whole problem was impossible, for the data never had been gathered on which such an understanding could be based.

A few specific cases will illustrate this point. After the great flood of 1897 the Mississippi River Commission established a standard levee grade for the entire river below Cairo. This standard grade was to be three feet above the height the water of 1897

would have reached if confined between levees. Now there are several great tributaries entering the Mississippi—the Upper Mississippi, the Missouri, the Ohio, the White, the Arkansas, and the Red. In 1897 some of these were greatly in flood, and others were not. To plan the levee system as though the 1897 flood was typical of all floods was certainly rule-of-thumb engineering.

In 1912 another great flood occurred, and again the levees were broken. (They had not all been brought up to the 1897 standard.) Thereupon a new standard levee height was adopted by the Commission, which was three feet above the 1912 high water, similarly determined. In 1927, as might have been expected, there was a very different distribution of flood waters in the different tributaries, and the rule-of-thumb grade line of 1912 did not fit.

#### THE "LEVEES ONLY" POLICY

In the choice by the Mississippi River Commission of agencies for flood control there is a long tradition of similar rule-of-thumb methods. About 50 years ago the Commission adopted a policy of "levees only." No conclusive study ever had been made of other methods. The writer has step by step followed back the history of these arguments, in government documents and in technical literature, and always he has found generalizations, assertions and hazy references to former thorough studies, but never any evidence of the studies themselves.

The recent national meeting of the American Society of Civil Engineers, October, 1927, was largely given over to a discussion of the Mississippi problem. At that meeting there was presented the embarrassing spectacle of engineers of national reputation and long experience proposing widely varying and conflicting solutions to this great problem. The reason for this

conflict and confusion is that no one is in possession of the facts.

The Mississippi River Commission, in its absolute faith in the traditional doctrine of "levees only," has held that, except for working out conditions relating to levees and bank revetment, it had all the facts necessary, and has discouraged the thorough, patient and widespread work which must be the basis for any adequate and economical plan. Its members have stated repeatedly and unequivocally that there is no material uncertainty about the cost of complete and final protection. It has discouraged thorough investigation by its statement to the effect that the work was rapidly approaching final completion. Yet today it is unquestionably true that never in the history of the Mississippi River Commission have its estimates of the cost of completing its work been more than 10 per cent or 20 per cent of the true cost. That tragic result of rule-of-thumb engineering would have been unnecessary if the methods of modern engineering analysis had been in control.

#### A THOROUGH STUDY OF THE PROBLEM NEEDED

What should be done?

First, we should know the facts. Second, we should have a scientific analysis and interpretation of them. And, third, after a comparison of all possible methods and combinations, a comprehensive plan should be adopted.

An emergency is to be met, and first of all we should know what is necessary to bring the river back to its past stage of control. Already much of this work is being done.

With the immediate emergency cared for, the necessary time should be taken and expense incurred to make a study of all phases of the river problem, and to prepare plans for permanent control. Such a study probably would take ten

years or more, though much effective work will be possible during that time.

#### USE FOR A HYDRAULIC LABORATORY

We must understand the behavior of the river. To this end a part of the necessary studies can be made best on the river itself, and part in a hydraulic laboratory. The establishment and maintenance of such a laboratory would help greatly to solve many perplexing problems of river control. It is possible on a small scale to discover many of the laws and characteristics of water flowing on a large scale. Some of the finest hydraulic design ever worked out under the writer's direction was developed by that method.

Along with the hydraulic laboratory there should be a far more thorough and intimate study of the river than has ever been made. At what velocities does it deposit silt? At just what velocities and under just what condition does it cave its banks? To what extent does the whole river bottom move during high water? What would be the effects of outlets and spillways? What conditions are necessary to prevent a shallowing of the channel?

We need to know more about the origins and possibilities of floods. How much has each tributary contributed in the several floods? (Far too little is known on this point.) What is the probable maximum flood on each tributary in 10, 25, 50, 100 and 500 years? What is the probability of coincidence of floods on various tributaries? How would such coincidence affect floods on the main river? What is the effect of levees on these lower tributaries in forcing the water into the main river?

#### A STUDY OF VARIOUS METHODS NEEDED

We need to know about the feasibility and value of every possible

method of flood control on the Mississippi, and of every possibility of combination of different methods. It might seem on first thought that this would mean an endless job of comparing an infinite number of possible combinations, and that no final and conclusive *best* ever could be reached.

This is not the case. Such an analysis can proceed from the smaller components to the greater, with the orderly, methodical elimination of the less desirable methods, so that the problem moves surely and steadily to the one best solution, which probably will be a combination of many methods. So far as the writer is aware, the first clear statement of such a process of large scale definitive engineering analysis is given in the technical reports of the Miami Conservancy District.<sup>1</sup>

There must be a study of the possibility of diversions and outlets from the main river and from its tributaries, of reservoir control, and of spillways, as well as of control by levees and revetments. There has been much heated argument for and against these alternative methods, but no adequate study of them. There must be a study of the greatest possible combination of flood which it is wise to protect against, and of the methods and devices for limiting damage in case that maximum is exceeded.

For 50 years the public has been made to believe that the Mississippi problem lay in a choice between levees and other methods. Such is not the case. A final correct design without doubt will be a combination of several methods, each used in the places and to the extent that is most effective.

There should be a study of the re-

sponsibility for flood damage, to determine whether and to what extent any habits of the northern states have increased flood damage below. The writer is of the opinion, from the most careful study available, that the case of the Lower Mississippi against the north in this respect is almost absolutely unsupported by any evidence. If there is such evidence it should be discovered and carefully weighed.

Unless the Lower Mississippi is to become permanently a pauper region to be cared for by the National Government, there should be a study of the equitable distribution of the cost of protection.

#### NEED FOR A REVIEW OF THE LEGAL NECESSITIES

The legal necessities of the whole situation should be reviewed. The writer believes that an amendment to our National Constitution may be necessary to give the National Government the power to do work wherever it is most necessary and to assess the cost in an equitable manner. We are now living under a hypocritical fiction. Improvement of navigation, being under federal control, is made the excuse for flood control. By gradual accumulation of precedent we are, in fact, amending the Federal Constitution, but in such a partial and inefficient manner that the Federal Government is acquiring obligation for flood control without the necessary powers for its proper execution. To try to solve the problem of the Mississippi without improved legal machinery will result in distortion and monstrosity. The legal structure of flood control should be as well built and as comprehensive as the engineering design.

Such are some of the types of information that should be collected, and of preparation to be made. Perhaps ten years will be required under good ad-

<sup>1</sup>"Hydraulics of the Miami Flood Control Project." Technical Reports, Part VII, Chapter XII. Published by the Miami Conservancy District, Dayton, Ohio.

ministration to accomplish those purposes.

Given the information, the task remains of synthesizing a comprehensive program. During the whole period of preparation this synthesis would be made tentatively again and again to throw light on the process of gathering information. When a general plan is finally adopted by this method it will have the respect and confidence of the engineering profession and of the nation, and there will not be the conflict of opinion among representative engineers that now characterizes a discussion of the Mississippi problem.

#### A HASTY SURVEY IS INADEQUATE

The hasty survey now being made by the War Department, in an effort to make up for half a century of unfounded assurance, cannot accomplish in a year or two what is necessary for the preparation of an adequate plan. To present a plan to the present Congress that would, in fact, commit the nation to a far-reaching policy for the Mississippi, would be a great national disservice.

The more courageous and honorable attitude would be to face the issue and to inform the American public of the true facts. It is not impossible that, by the premature adoption of a policy for the Mississippi, the country may be led to the wasting of hundreds of millions of dollars, to find itself 20 or 30 years from now faced with another tragedy, and still lacking the fundamental information on which an adequate plan can be based.

No similar problem of similar size ever has been mastered by men. The issues transcend rule-of-thumb methods. Only a thorough analysis into fundamental elements, with a new and creative synthesis, is adequate. Just as the architect of the skyscraper had to escape from the stone mason, and as the railroad creator had to escape from the horse and wagon, in order to fulfil their destinies, so the engineers who conquer the Mississippi must be able to see over the tops of the levees and to think and to design as scientists. They must stoop to the study of minutest elements, and must reach to a mastery of the whole. That attitude has yet to be in evidence.



## Some Essential Principles of Water Conservation As Applied to Mississippi Flood Control

BY HON. GIFFORD PINCHOT  
Formerly Governor of Pennsylvania

**T**HE first need of life on this planet is water. A man can live nearly as many weeks without food as he can live days without water. Moreover, it is the supply of water, and not the area of land, which will limit the number of people who can live in the United States. We have land enough for vastly greater crops and hence for a vastly greater population than we have water enough to sustain or produce.

Running water in rivers and source streams, therefore, is the most important of all natural resources, more important in certain ways even than the forest, and that is a large admission for a forester. Twenty years ago the studies of McGee showed for the first time the real position of water in the economy of the Nation.

Not only food supply, but the supply of clothing and the supply of wood are dependent upon the presence of water in sufficient quantity for vegetable growth. Water, moreover, is a cheap carrier of bulky goods, a source of vast and perpetual mechanical power, a carrier away of noxious wastes, and a giver of health, vigor, and delight through recreation.

At the same time water uncontrolled may become a destroying agent of the first rank. The greatest natural calamity in the history of the United States is the recent Mississippi flood. That such calamities are confined to no one river system is proved by the still more recent disaster in northern New England.

Soil conservation is largely water conservation. The prevention of ero-

sion is a question of handling water, while the getting or foregoing of new acreage through swamp drainage likewise depends upon the handling of our water supply.

In dealing with water, the law gives the public a freer hand than in dealing with other natural resources. Land, for example, may be owned absolutely in fee simple. But running water in its nature is a fugitive thing, and it is not subject like land to absolute private ownership.

You may use the stream which runs by your door, but it is not your stream. Others have rights in it also. The law, consequently, gives the state large powers over it, much larger than any powers the state has over land.

As to water, the public right is dominant, the private right subservient. Moreover, wherever its use affects navigation, albeit indirectly, the authority of the Federal Government is supreme.

We have made but a poor use of these large public powers over water. Our dealings with our rivers have been haphazard, uncoordinated, wasteful, political. It is well to remember that famous river in Texas where it was proposed to spend the money of the Nation not only to dig a navigable channel, but to build pumps enough to put water in the channel when dug.

Our dealing with water has been the result of viewpoints and habits acquired when we had abundant water supply for a sparse population in a humid climate. These habits, legal and otherwise, were found to be un-

suited to the same sparse population in an arid climate. We were obliged to adopt legal principles outside the English common law to meet physical conditions outside the experience out of which that common law had sprung. Eventually we shall have to consider how far the common law principles have become unsuited to a dense population even in a humid climate, but that time is not yet.

Nation, state, municipality, corporation, and individual citizen have each dealt with water here and there from time to time as need arose without comprehensiveness of view, consistency of purpose, unity of method, or co-ordination of effort. The times are ripe for a change in policy.

Two decades have passed since Roosevelt's Inland Waterways Commission, in a sane and courageous report, summoned all men of intelligence and vision to unite behind a wise and foresighted policy for the control and development of our river systems. Such a policy, to take the place of the selfish, scrambled, local policies which have hitherto stood in the way of the comprehensive and effective development of our rivers, must be built upon principles or considerations such as the following:

#### WATER CONSERVATION PRINCIPLES

Every stream and every river system is a unit from its source to its mouth, and common principles and one general policy should control in all uses of it and dealings with it throughout its whole extent.

The common plan and policy should take carefully into account all of the different ways in which water can be made to serve mankind, such as domestic water supply, industrial processing, sewage and waste disposal, irrigation, draining, power, navigation, and recreation.

When any of these uses are mutually exclusive, preference must always be given to the higher use over the lower, usually in the order of domestic supply, waste disposal, irrigation, power, and navigation.

All uses of the water and benefits to be derived from its control should be kept carefully in view. One of the greatest dangers to wise and effective stream development is that undue emphasis on local or temporary advantages will make forever impossible the complete utilization of the resources of the stream.

The authority and undertakings of Nation, states, municipalities and individuals should be pooled to attain a common object and execute the several parts of a common program.

In executing such a common program it is of the first importance that all existing National, state, and municipal public rights of control and public property rights shall be maintained unimpaired.

In establishing control of any stream or any river system for flood prevention or any other purpose, every useful and available means of establishing such control, including levees, spillways, soil conservation, forest conservation, storage reservoirs, and any others, should be considered and made use of to the fullest practicable extent.

In all projects for stream control, the feasibility of securing repayment, in whole or in part, of the expense of such control from the development of electrical power through storage and other reservoirs, and from assessment of resource values directly created by such reservoirs, should be fully considered and put to use when available.

The execution of the new policy and plans under it should be taken wholly out of politics and put beyond the hazards of annual appropriations.

The allotment of costs between the

National Government and local interests should be established in each case upon the basis of the local benefits to be conferred and the ability of the localities to pay.

#### THE KIND OF COMMISSION WE NEED

The foregoing brief statement indicates partly, but only partly, the complexity and reach of the problem of controlling such a river system as the Mississippi River. As the largest conservation problem ever undertaken by any nation, and as affecting most vitally the vast central valley of the United States, this gigantic adventure of bridling the Mississippi deserves the best skill and experience this country can provide.

The Mississippi problem is the biggest half of our waterways problem and it consists of two parts. The first concerns immediate relief for the situation of the moment; the other, the permanent cure of floods and the complete utilization of the Mississippi River system. The preparation of a plan for the latter should be attempted only under the direction of the most competent men this nation can supply.

My suggestion is that a commission consisting of the foremost engineers and experts in every one of the lines involved—electric, hydraulic, forestal, agricultural, social, financial, and any

others—should be selected for two purposes: First to acquire or assemble the necessary basis of fact concerning the Mississippi system—facts which the Army Engineers have most unfortunately neglected to secure; and secondly, upon the basis of these facts to prepare a general plan under which this vast undertaking may fairly be expected to produce results.

It is now proposed by certain interests to entrust this enormous task to the Corps of Army Engineers through the Mississippi River Commission, which it dominates. These two bodies, by their insistence on the policy of levees only, long after repeated disastrous floods had proved it unsound, have committed, in my opinion, the most colossal engineering blunder in human history. To leave the future of the Mississippi in the hands of these same men would be to certify failure in advance.

If this plan to employ the foremost experts in this, the foremost conservation enterprise of mankind, is sound, then the same general procedure will apply, in its degree, to other similar but smaller undertakings. The essential thing is to make use of the best we have in knowledge, experience, and achievement, and to learn from the blunders of the past how to avoid falling into the same pit.

## The St. Lawrence Waterway Project

By FAYETTE S. WARNER  
University of Pennsylvania

**T**HE St. Lawrence Waterway Project, from the engineering point of view, consists in the canalization of the St. Lawrence River, making it available to ocean-going vessels, from Montreal Harbor to Lake Ontario.

This portion of the river, a distance of some 182 miles, flows over an undulating plain in which it has carved scarcely any valley. The river has an average width of about a mile from Cornwall to Lake Ontario. Below Cornwall (Plate I), it widens to five or six miles in three places, forming Lake St. Francis, Lake St. Louis and the La Frairie Basin, which are connected by the famous Cedar and Lachine Rapids, respectively. A series of rapids occurs above Cornwall which extends up the river to Prescott. The rapids are caused by the river flowing over bed rock formation which outcrop at these places. It is the drowning of these rapids by building dams at certain proposed points, thus creating large tranquil pools and the connecting of these pools and lakes, with canals and locks, which forms the main engineering problem to be solved. To the engineer the problem is not unsolvable.

Starting from Montreal Harbor, the first division of construction necessary will need to overcome the rise of 8 feet to the level of La Frairie Basin, the drowning of the Lachine Rapids by building a dam near the vicinity of Heron Island and dredging the shoals at the lower end of Lake St. Louis.

It is proposed to locate the first lock about 2000 feet down stream from Victoria Bridge and just north of the Mackay Guard Pier, as shown in Plate II. The locks are to be the same size

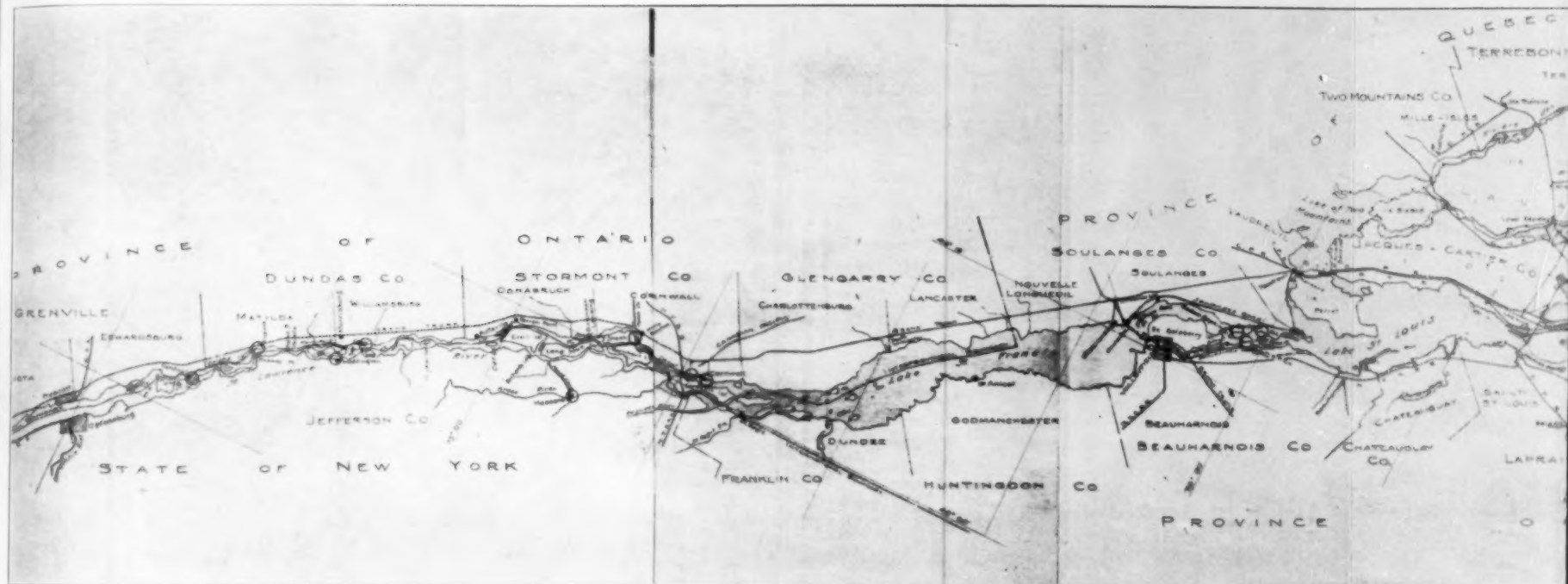
as those at the New Welland Canal, which climbs the Niagara Escarpment, and will be completed by 1930. These locks are 860 feet long by 80 feet minimum width with sills for 30-foot draft. This lock will raise the level to an elevation of +52 feet.

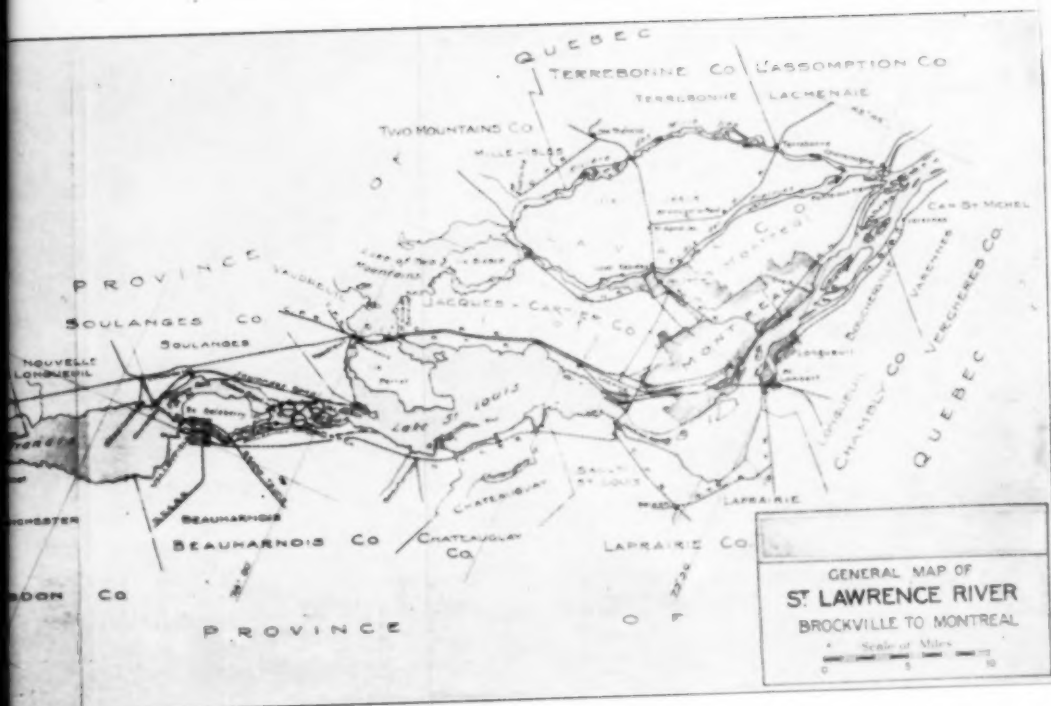
It might be added that it has been proposed to build a low dam just south of Victoria Bridge and raise the level of La Frairie Basin, using it as a part of the course and gain the use of the low head for power. This plan probably will not be carried out because of the very long dam to be built; the excessive amount of dredging necessary to gain the ship channel; the excessive amount of dike building around the basin and the town of La Frairie in order to protect it from inundation during periods of heavy flow; the necessity of buying a large acreage to prevent property damage; the probable loss of the use of the power-generating units when ice jams occur in the lower St. Lawrence, causing the flood waters to set back over the dam. The return from this low head development would not be great enough to offset the costs.

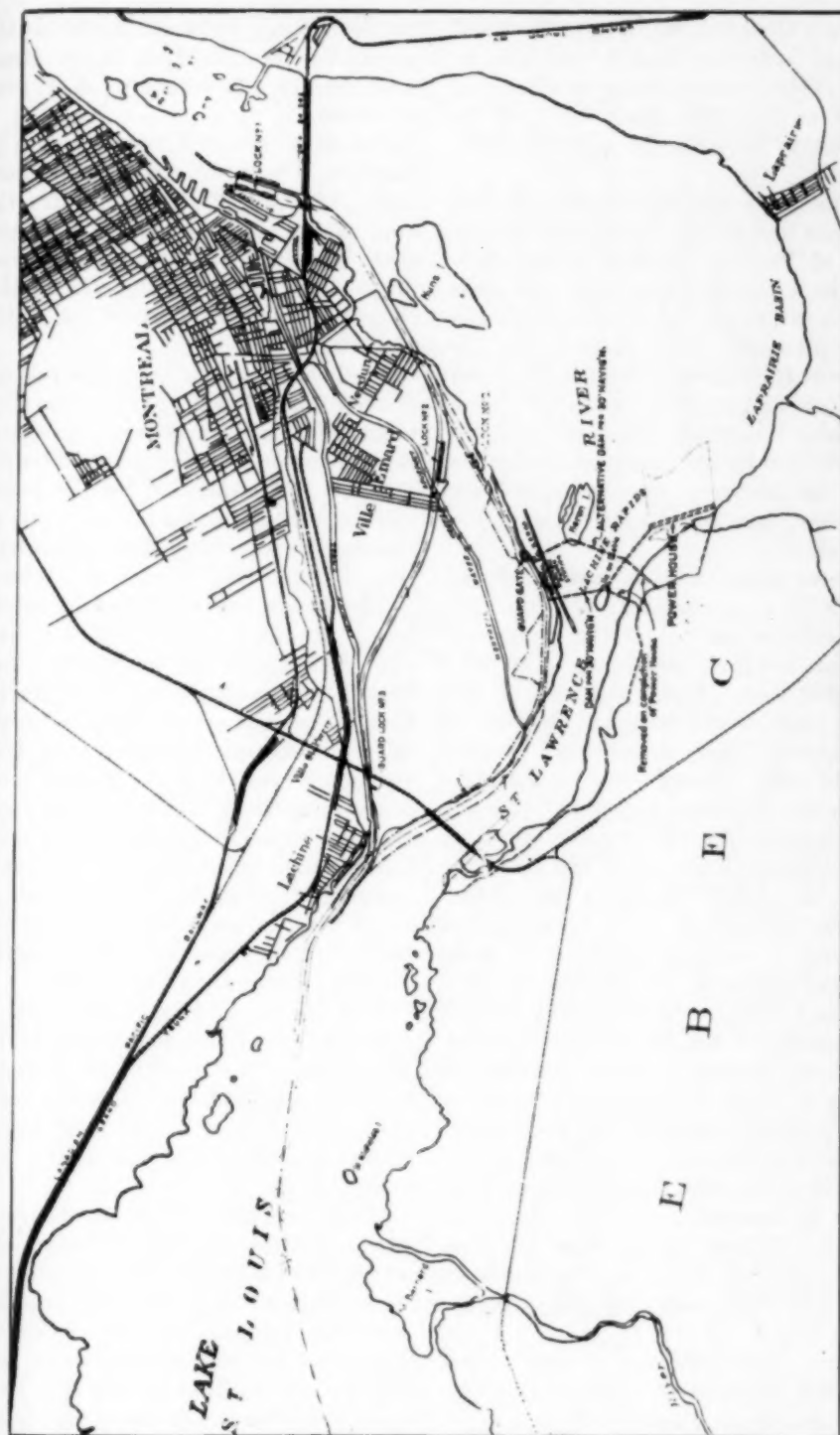
From Lock No. 1, the course of the route will probably pass through the west approach to Victoria Bridge, necessitating the building of probably two lift bridges to carry a total of three railroad tracks, one electric line and the highway. From this point the course will follow the shore line approximately, passing to the west of Nuns Island. On the river side of the canal a concrete retaining wall backed by an earth fill toward the river and paved to provide against damage by ice and wave action is proposed.



PLATE I







THE LACHINE RAPIDS DIVISION OF THE ST. LAWRENCE PROJECT

There is already a dike on the Montreal side of sufficient height and size to protect the riparian property which will serve as the land bank. It will be necessary to pave it against wave action.

This course continues practically in a straight line about a mile past the village of Verdun, where a second lock will be located. This lock will raise the elevation to that of Lake St. Louis. This plan calls for a dam across the Lachine Rapids some 4000 feet beyond the lock and in the vicinity of Heron Island. Its exact location will be determined by the cost of construction and maintenance of the temporary diversion dam during the construction period.

There seems to be an excellent foundation of rock averaging  $2\frac{1}{2}$  to 5 feet beneath the surface of the rapids extending out from both banks from 1000 to 1300 feet. These portions of the dam, then, would be relatively easy to construct. The remaining portion would offer greater difficulty, as the Canadian District Engineer<sup>1</sup> pointed out, because the whole river seems to rush through a gap some 400 feet at a rate of about 30 miles per hour. Several soundings were taken which seemed to indicate that there were several points in the gap which were 200 feet deep. Another heavy cost to be thought of will be the large amount of earth and rock to be removed in order to carry the volume of water to the probable location of the power house, and the still heavier cost of excavating the rock for the tail race, as it is as necessary to take the large volume of water away from the turbines as it is to bring the water to them, in order that they may operate efficiently.

This development will give about 700,000 horsepower, which, according

<sup>1</sup> District Engineer Yule.

to the District Engineer, could be absorbed by the industries at Montreal and vicinity immediately, if it were available.

The canal channel from the dam to Lachine Wharf will follow the shore line. At this point it will enter the deep water of Lake St. Louis, where there is a stretch of 14 miles of almost unrestricted sailing. The cost of this project is estimated at about \$145,000,000.

It is a little less costly for this portion of the route if both the power development and waterway are developed together since there is a demand for the power. If the demand for the power did not exist, it would be less costly to develop the waterway on an inside land route through Ville Emard to Lachine.

The inside route contemplates the power development coming at a later date; but the initial cost of each would be greater, developing them separately than to use the above described route which contemplates developing both the power and Lachine Rapids route at the same time. It is also to be noted that the inside route will be only a 25-foot channel until the power project is completed, whereas the Lachine Rapids route with the power development will be a 30-foot channel from Montreal Harbor through Lake St. Louis.

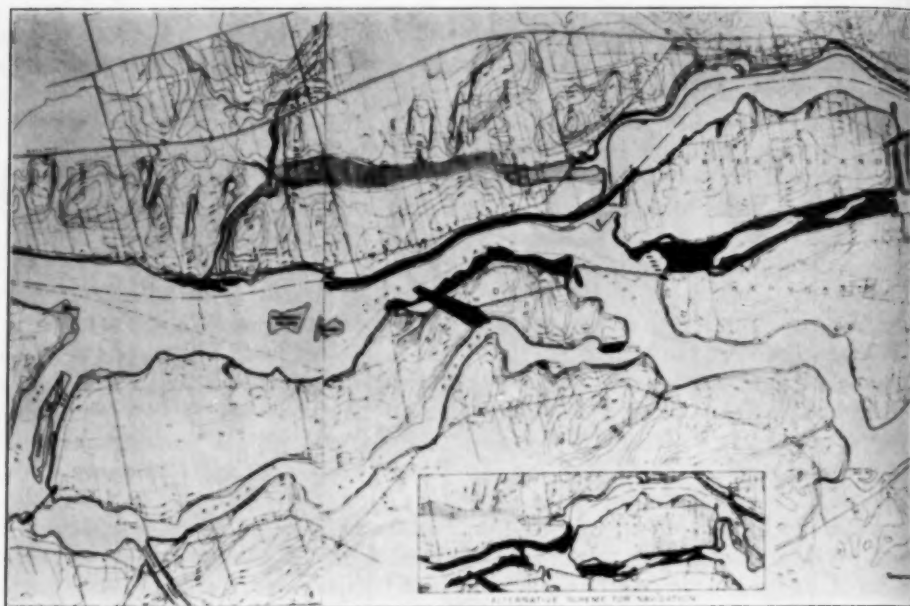
The second division (Plate III) of construction is the connecting of the upper end of Lake St. Louis with the lower end of Lake St. Francis. The difference in level between the two is 83 feet, Lake St. Francis being at a level of +152 feet.

These two lakes are separated by a series of three rapids, Coteau, Cedar and Splitrock Rapids, over a total distance of about 16 miles. It is possible, and the foundations are such that dams can be built at the foot of each rapid, thus ponding the water. However, this idea can be immediately dis-





## PLATE IV



THE BARNHART ISLAND DEVELOPMENT AT CORNWALL — INTERNATIONAL SECTION

missed from practical consideration because of the enormous cost of building diversion dams for the construction period.

It has been proposed to build a canal around the rapids on the south side of the river. Entrance from Lake St. Louis is near Melocheville. The locks of 41-foot lift each are located not far from the village which will raise the level to that of Lake St. Francis. The foundations of these locks will rest on bed rock. The canal will then continue in a straight line for about six miles, followed by a series of gentle sweeping curves to the right for a distance of four miles. A tangent of three miles brings the canal to the shore of Lake St. Francis.

It will be necessary to dredge a channel of two miles to deep water in Lake St. Francis. The entire canal can be built through Champlain clay with a width of 450 feet at the top, a depth of 30 feet, and a provision for widening

to 600 feet in the future at a cost of \$40,000,000. This includes all costs, bridges, railroad fills and guard locks at Lake St. Francis. Power can be developed at a later date without any interference with navigation at a cost of \$152,000,000 for 1,560,000 horsepower.

If power is developed at the same time that the waterway is built, then another scheme can effect a saving of about fifteen million dollars to the development of power. This scheme can be carried out on the north side of the river, by constructing a dam across the river above the town of Cedars from Point a Brion to Point du Domaine, and building a large power canal running back of the village of Cedars to a power house located just north of the point where the present Soulanges Canal enters Lake St. Louis.

The new ship canal would lie north of the power house with the first lock at the entrance and the second further up Chamberry Gully. The plan would

PLATE IV



Div. 4 — Lower Dam

necessitate a guard lock between Broad Island and Grande Island, with an embanked channel and regulating works at Thorn Island; also, dredging from Thorn Island to Prisoner Island in order to care for the heaviest floods and winter conditions.

This plan contemplates a 30-foot channel for \$55,000,000 with a very easy power development at a later date at a cost of \$125,000,000, or at a total of \$180,000,000.

It seems likely that the demands for power will be so great by the time that this project will be completed that it will pay to embark on the second scheme of development rather than the first.

The Third Division of construction is the deepening and widening of the channel through Lake St. Francis. It is a distance of 28 miles and a channel 450 feet wide by 30 feet deep is estimated to cost \$1,820,000.

The Fourth Division (Plate IV) of the development, known as the Inter-

national section of power development, comprises a distance of about 50 miles between Cornwall and Prescott.

The scheme that will probably be used is known as scheme "B" in the International Joint Commission's report which provides for the least amount of land inundated. This scheme calls for a two-stage power development making the total amount of land inundated 6000 acres.

The lower dam and power houses will be located between the lower end of Barnhart Island and the mainland on the Cornwall side intersecting Lock No. 20 of the present Cornwall Canal some three miles above the village. Another dam in this series is to cut off the main Long Sault Rapids and is located at the upper end of Barnhart Island to a point near the lower end of Long Sault Island.<sup>2</sup> The third dam

<sup>2</sup> The investigation of foundations by tunneling under the river was being carried out by U. S. Engineers in the summer of 1925.

will regulate the flow to the Massena Power Canal and connects the upper end of Long Sault Island with the eastern shore.

It will be necessary to carry out considerable dredging and enlarging of the channels in order to care for the volume of water at the several points in this portion of the development. The cut at Polly's Gut must be enlarged in order to care for the swift water and to lower the velocity of the river on the north side of Cornwall Island. A large amount of earth and rock removal are necessary at the Barnhart development; also, the channel must be widened and deepened between Shiek Island and Barnhart Island to bring full delivery to the forebay of the power house. An additional channel and control dam will be placed near the lower portion of Long Sault Island to care for extreme high water and to divert the flow during construction of the Long Sault dam. The proposed waterway channel necessitates a large amount of dredging to be carried out on the north side of Cornwall Island from the upper end of St. Regis Island to a point just southeast of the village where Lock No. 7 will be located. This lock will carry the level to elevation +200 feet. The canal will continue overland for about three miles to Lock No. 8, which will have a lift to elevation +210; again continuing in a straight line to the stillwater north of Shiek Island which is created by a dam from the lower end of Shiek Island to the mainland and a dam which already exists from the upper end of Shiek Island to the present Cornwall Canal embankment. From this point to Morrisburg (Plate V), it is practically open water, but it will be necessary to do some dredging between Weaver's Point and the entrance to Lock No. 9 which will be located about a mile west of the village. A dam will

be built at this point from the mainland to Ogden Island, from Ogden Island to Clark Island, and from Clark Island to Murphy Point. Two power house developments will be located on either side of Clark Island, while the sluiceway and spillway will be in that portion of the dam that crosses the main section of the river. The Morrisburg dam raises the elevation to +242 feet, thus creating stillwater with only the proper amount of gradient from Morrisburg to Lake Ontario. Some dredging will be necessary above Morrisburg in order that the full amount of water may be easily discharged under a low velocity as it is now being discharged under the high velocity of the rapids. The total amount of water power developed at Barnhart is 1,250,000 horsepower and at Morrisburg 600,000.

The total cost of this division including power, 30-foot navigation and all damages, is estimated to be \$212,000,000.

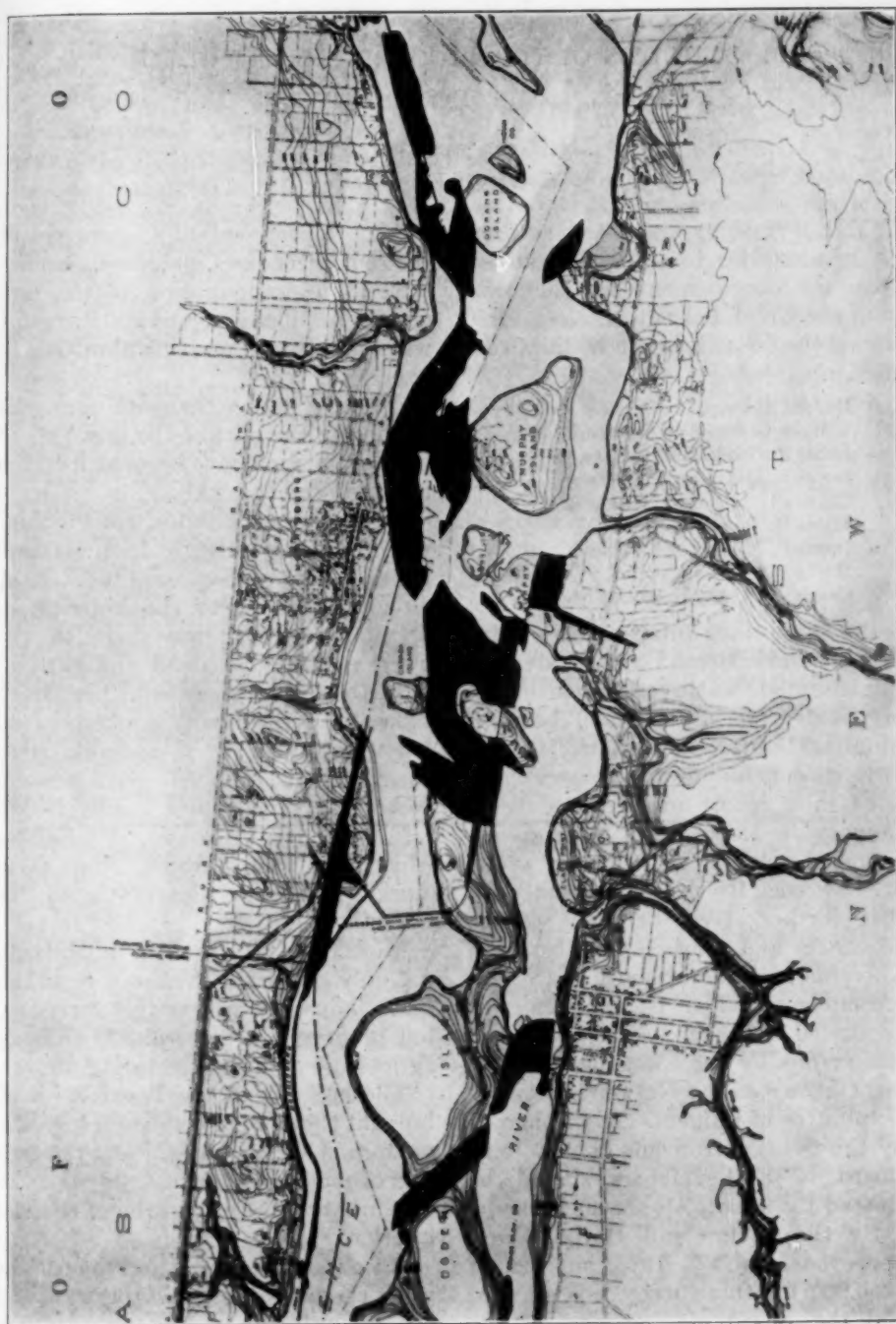
The Fifth Division, from Chimney Point to Lake Ontario, is 65½ miles long, with a fall of about one foot. The channel is deep and wide, having a minimum width of about 500 feet through the Thousand Islands. A few points of rock found above grade of 30-foot channel can be removed for an estimated cost of \$100,000.

The total improvement, as outlined, is estimated to cost about \$539,000,000, of which about \$125,000,000 is chargeable to navigation, and \$414,000,000 to power, averaging about \$100 per horsepower developed.

#### REFERENCES

- St. Lawrence Waterway—International Joint Commission Report.
- Ontario Hydro-Electric Power Commission Report.
- Report on Structural Materials along the St. Lawrence River, Department of Mines, Canada.

PLATE V



Div. 4 — Upper Dam

THE MORRISBURG DAM — INTERNATIONAL SECTION



## A Synopsis of the Hoover Report on the St. Lawrence Shipway

By FAYETTE S. WARNER  
University of Pennsylvania

THE President appointed a Commission March 14, 1924, to advise upon the development of a shipway from the Great Lakes to the sea. He named the following men to the Commission:

Herbert Hoover, Chairman  
William C. Brood of New York  
James P. Goodrich of Indiana  
James E. Davidson of Michigan  
Charles L. Allen of Massachusetts  
James R. Howard of Iowa  
James P. Noonan of Missouri  
Stephen B. Davis, Counsel  
Charles P. Craig, Executive Secretary

In 1919, the International Joint Commission between United States and Canada made an investigation of the proposed river improvement between Montreal and Lake Ontario, setting forth its conclusions and recommendations in a report under the date of January 6, 1922. That Commission endorsed a plan for improvement of the St. Lawrence River and recommended that further study be made of the economic and engineering features. Therefore, in accordance with this recommendation a Commission was appointed by the President and a similar one by the Canadian Government known as the National Advisory Committee of Canada. It was agreed by the two governments that a Joint Board of six engineers should be created and a complete survey be made.

By the Rivers and Harbors Act, approved March 3, 1925, an item of \$250,000 for this survey was allotted and the Board of Engineers of the United States Army were directed to make the examination.

The Department of Commerce, at the request of the Commission, undertook a full examination of the economic questions involved and its report was completed and transmitted in January, 1927.

All this data together with numerous studies on the part of the members of the Commission have brought it to the following conclusions:

1. The construction of such a shipway from the Atlantic to the Great Lakes, as is proposed, will be of great economic benefit to the lowering of present transportation costs to the interior of the continent and particularly to the region around the Great Lakes. This territory embraces the following states: Ohio, Indiana, Kentucky, Illinois, Iowa, Missouri, Kansas, Nebraska, North and South Dakota, Montana, Wisconsin, Minnesota, Michigan, Pennsylvania and New York. It also includes a large part of Canada.

More than forty million inhabitants not only gain their livelihood from the basic industries within this territory, but produce a large surplus both from agriculture and manufacturing.

The building of the Panama Canal brought the eastern coast nearer to the western in cheaper rates. But the gain was of much greater advantage to the eastern coast region than to the interior.

If we take for illustration the cost in cents carrying a ton of staple goods at the present rate, using the cheapest route, we find that previous to the war, New York was 1904 cents away from

San Francisco, while it is now only 1680 cents. Chicago, which was 2610 cents away from the Pacific coast before the war, is now 2946 cents away. In other words, Chicago has moved 336 cents away from the coast, while New York has moved 224 cents nearer.

Similarly it can be shown that Chicago has moved about 594 cents away from the markets of the Atlantic Seaboard and South America. This same ratio applies to other mid-western points.

The increases in rates have affected this section from 6 to 18 cents per bushel upon grain, while similar increases have not taken place in competing countries, which have greater access to the seaboard. Hence, this deduction of freight rates comes out of the mid-continent farmers' receipts. The effect of completing such a shipway as the proposed St. Lawrence improvement would be to gain a substantial reduction in the cost of transportation, and would be a direct cause for raising the price levels of all grain in the lakes transportation area.

Other industries would be affected by the same type of economic reaction. It has been estimated that the returns in a single year to the farmers would equal the capital cost of the waterway.

2. There are three different routes proposed:

(a) The reconstruction of the present canal from Lake Ontario to the Hudson, using the new Welland Canal now under construction by the Canadian Government to connect Lake Ontario and Lake Erie. The United States has treaty protection in equal treatment in the use of the Welland Canal.

(b) An "All American" route, which would use the same route, but would construct a new ship canal on the south side of Niagara which

would duplicate the Welland Canal.

(c) By using the St. Lawrence River under joint agreement with Canada.

3. Depth of Shipway. It is proposed to build all permanent structures for a depth of 30 feet, but to make the connecting canals only 25 feet, as that draft will at present admit 88 per cent of all ships entering American ports.

The capacity of this canal is estimated at 30,000,000 tons per year if a single chain of locks is used. This capacity can be increased to almost any desired amount by constructing parallel locks.

4. The Department of Commerce estimates the following tonnages by routes:

	<i>Minimum Tons</i>	<i>Maximum Tons</i>
Ontario-New York route	15,000,000	20,000,000
St. Lawrence route . . . .	21,000,000	25,000,000
Median . . . . .	17,500,000	23,000,000

80 per cent represents imports and exports.

20 per cent represents internal traffic.

5. The United States Engineers report of December 6, 1926, estimate the cost of construction of a ship canal: Lake Ontario-Hudson route, \$506,000,000; All American route, \$631,000,000; St. Lawrence route, \$123,000,000 to \$148,000,000, depending upon the quantity of hydro-electric development. The All-American or Lake Ontario-Hudson routes would not develop power.

6. The development of the St. Lawrence for power is inevitable. Complete development will give about 5,000,000 installed horsepower of which 2,250,000 horsepower lies in the international section. It is profitable to develop this river for power, and this would eventually create a shipway even though the other routes are undertaken.

7. The requirements for power by the Province of Ontario, New York

and New England States will be great enough by the time the project in the international section is completed to absorb the entire output.

The development of power of this section with an additional expenditure from \$22,000,000 to \$34,000,000, depending upon the details as to whether it is a two-stage or single stage, for locks and canals would carry the shipway 141 miles out of the total 183 miles from Lake Ontario to Montreal, or within 42 miles of tidewater. There are two plans, first, by building a shipway around the rapids completely independent of any future power development, and second, by making use of a partial development in order to offset future costs to the complete development of power.

The first method will cost about \$97,500,000, while the second would cost about \$161,000,000. The second method is recommended by the Joint Board of Engineers.

9. It is possible that other agencies than the governments themselves will be given the right to develop the power. However, the undertaking is of such a nature that the power development and navigation project will probably be carried out as a joint one between the United States and Canada.

The method as to how the costs shall be shared by the two countries has not been determined.

10. Comparison costs of maintenance with interest at  $4\frac{1}{2}$  per cent of the three routes are:

	<i>Per Year</i>
All-American.....	36,000,000
Lake Ontario-Hudson.....	28,770,000
St. Lawrence.....	\$10,000,000

These estimates applied to the annual tonnages on these routes are:

	<i>Per Ton</i>
All-American.....	\$2.06
Lake Ontario-Hudson.....	1.64
St. Lawrence.....	.43

11. Comparison of restricted navigation routes:

	<i>Miles</i>
All-American.....	137
Lake Ontario-Hudson.....	128
St. Lawrence.....	25

Obstructions to navigation:

	<i>Locks</i>	<i>Bridges</i>
Lake Ontario-Hudson.....	20	54
St. Lawrence.....	9	8

The St. Lawrence route is nearer northern European ports by 625 miles than would be the Lake Ontario-Hudson route; but it is 1,550 miles further to New York and from 450 to 1,350 miles further to South Atlantic ports. These distances, however, are compensated for by better navigation in the St. Lawrence route.

12. The time required for construction has been estimated to be eight years, but it may be assumed that ten years will be the minimum period even though all international questions, legislation, administrative and financial problems can be rapidly overcome.

13. It is hardly necessary to discuss the military advantages of one route over the other, but they may be summed up in the words of the Chief of Engineers: "The military advantages of the proposed waterway across the State of New York are not sufficiently great enough to affect the consideration of a matter involving hundreds of millions of dollars. It will be noted that many points of both routes are so close to the border as to make them subject to possible destruction in case of war."

14. It is noted that the State of New York has a special interest in the development of power on the St. Lawrence route, but owing to the international character of the river, it will be necessary that the Federal Government assent to and negotiate power development questions from the American side.

15. It is feared by some eastern seaboard cities that in case the St. Lawrence route is constructed that they will lose some transfer and shipping business.

It may be stated that the total estimated tonnage for this route equals only 4 per cent of the present tonnage carried by the American Railway systems which now connect the Lakes with the Atlantic Seaboard. It is equal to only 12 per cent of the shipments now moving through American sea ports. It is theoretically possible that the natural increase in traffic during the years of construction will increase to enough to completely offset any decrease that may come to American seaboard ports.

The conclusions of the Commission are:

1. The construction of the shipway from the Great Lakes to the sea is imperative.

2. The shipway should be constructed on the St. Lawrence route, provided suitable agreement can be made for its joint undertaking with the Dominion of Canada.

3. That the development of the power resources of the St. Lawrence should be undertaken by appropriate agencies.

4. That negotiations should be entered into with Canada in an endeavor to arrive in agreement upon all these subjects.

# Engineering Aspects of the St. Lawrence Waterway

By G. B. PILLSBURY

Lieutenant Colonel, Corps of Engineers, U. S. Army

**T**HE purpose of the St. Lawrence Waterway is to afford an efficient water transportation route from the Great Lakes to the sea. Its engineering aspects deal primarily with the best means for creating such a highway for deep-draft shipping. But this is only part of the problem. The portion of the St. Lawrence that now remains a bar to such shipping has potential power resources whose eventual development will be an economic asset of far-reaching importance to the two nations concerned. The engineering problem is then to find the best means of co-ordinating improvement of the river for through deep-draft navigation with the immediate or ultimate development of its power resources.

From the point where it leaves Lake Ontario, the St. Lawrence lies along the boundary between the United States and Canada for a distance of 115 miles, with the Province of Ontario on the north and the State of New York on the south. The river then leaves the boundary and flows through the Province of Quebec to the Gulf of St. Lawrence. The port of Montreal lies 180 miles downstream from Lake Ontario.

From Montreal to the sea, the Dominion of Canada has already provided a channel thirty feet in depth at low water, which has made that city one of the great ports of the continent. A project is under way to enlarge this channel to a depth of 35 feet. The part of the river which bars Lake navigation from the sea, and ocean navigation from Lake Ontario, is therefore the 180-mile reach from that lake to

Montreal. In this reach the river falls a total of some 225 feet over three successive series of rapids, lying between long stretches of deep, slow flowing water and expansions of the river course into lake reaches.

It is to be anticipated that hydro-electric generating machinery with a total installed capacity of some 5,000,000 horsepower will eventually develop the power economically utilizable from the large and uniform river flow through this section. More than half of this potential power lies on the portion of the river within the Province of Quebec.

The Great Lakes are of necessity an integral part of the waterway system of which the St. Lawrence Waterway would form a part. Each of the lakes has, it is needless to say, a depth adequate for vessels of any practicable draft, and the Straits of Mackinac, between lakes Michigan and Huron, also have ample depth for any navigation. The rivers connecting the other lakes are the limiting factor in determining the depth available for shipping on the lake system.

## IMPROVEMENT OF INTERCONNECTING CHANNELS

The interconnecting Channels from Lake Superior through Lake Huron into Lake Erie have been improved by the United States Government by channel excavation, and by the construction of four parallel locks at St. Mary's Falls, at the outlet of Lake Superior, to afford a transportation route normally available for vessels of 20-foot draft. Canada has contrib-



uted a fifth lock at the St. Mary's Falls. The recent low water levels on the lakes, due to a cycle of low precipitation on their drainage basin, and to the diversion of water from Lake Michigan by the Chicago sanitary district, reduced the available draft at one time to as little as 18 feet. The draft that can be carried at the present time is about 19 feet. A report on the advisability and cost of a further improvement of the interlake channels has been directed by Congress and is in preparation.

The transportation route afforded by the channels between the lakes has given rise to a water commerce of great volume, moving upward of 100,000,000 tons of commerce per annum. Most of this commerce consists of bulk cargoes of iron ore, coal and grain, carried in a special type of vessel, longer and of greater capacity than the ordinary ocean cargo carrier, but of lighter draft to meet the limitations of the channel depth. With the loading and unloading machinery provided at the lake ports, the transportation of bulk freight has reached an unparalleled standard of efficiency.

Lake Ontario lies at an elevation 326 feet below Lake Erie. Navigation from Lake Erie to Lake Ontario passes through the Welland Canal, constructed and operated by the Dominion of Canada. The present Welland Canal affords a depth of 14 feet and overcomes the difference between the levels of the lakes by a series of 25 lift locks. Canada has now under construction a new Welland Ship Canal, generally paralleling the present canal. It is 25 miles in length, with but seven lift locks and a guard lock. The lock sills are set to afford a depth of 30 feet. The portions of the canal first excavated were given a depth of 25 feet; the later contracts provide for a depth of 27 feet.

From Lake Ontario to Montreal 14-

foot navigation is now provided by side canals around the rapids in the St. Lawrence and by such channel excavation in the river as has been necessary for this draft.

The present Welland and St. Lawrence Canals form the connecting link, via Lake Ontario, between the general lake system of navigation and deep water at Montreal. This route is navigated by vessels of 14-foot draft, similar in design to the lake freighters, but of much smaller dimensions. They are relatively high-powered to meet the swifter currents of the St. Lawrence. The commerce via this route has been increasing rapidly in recent years, and is now somewhat in excess of 6,000,000 tons per annum.

In summary, navigation on the Great Lakes and the St. Lawrence now falls into three categories:

(a) Lake navigation, operating normally on 20-foot draft, on and between all the Lakes except Ontario.

(b) Canal navigation, 14-foot draft, between Lake Erie ports and Montreal via the Welland Canal, Lake Ontario and the St. Lawrence.

(c) Deep-sea navigation from Montreal to the ocean.

When the new Welland Ship Canal is opened, lake navigation will be extended to Lake Ontario, and will then be separated from deep-sea navigation only by the 180 odd miles of the St. Lawrence above Montreal. But if the St. Lawrence gateway was then opened, vessels exceeding 20 feet in draft would not be able to penetrate into the lakes beyond Lake Erie until the interlake channels are deepened.

#### IMPROVEMENT OF THE ST. LAWRENCE BETWEEN LAKE ONTARIO AND MONTREAL

Since it is in part a boundary stream, the improvement of the upper St. Lawrence is an international project.

Plans for the improvement of the river between Lake Ontario and Montreal were prepared in 1921 by a board composed of one engineer for the United States, and one for Canada. These plans were presented to the International Joint Commission, a permanent body created by treaty to deal with matters relating to the boundary waters between the two countries. The Joint Commission recommended that the two governments enter into a treaty arranging for the improvement of the river between Lake Ontario and Montreal. As it had received certain alternative plans for improving the international portion of the river for navigation and power, it further recommended that all plans presented be reviewed by an enlarged engineering board. In 1924 the two governments appointed such a board, known as the Joint Board of Engineers on the St. Lawrence Waterway.

#### THE JOINT BOARD OF ENGINEERS

The membership of the board was, for the United States, Major General Edgar Jadwin, Chief of Engineers, U. S. Army, Col. William Kelly, Corps of Engineers, U. S. Army and the writer; for Canada, Mr. Duncan W. McLachlan, of the Department of Railways and Canals, Dominion of Canada, Mr. Oliver O. Lefebvre, Chief Engineer, Quebec Streams Commission, and Brig. Gen. Charles Hamilton Mitchell, C.B., C.M.G., Dean of the College of Engineering of the University of Toronto. The report of this board was submitted on November 16, 1926, and appendices to the report, containing detailed discussions, plans and estimates, were filed in July, 1927. Under the instructions formulated by the two governments the report of the board included findings on certain collateral questions, such as the effect of diversions of water from the Great

Lakes on the levels of the lakes and of the St. Lawrence. There will here be considered only that part of the report which deals with the St. Lawrence itself.

#### REPORT OF THE BOARD

The St. Lawrence leaves Lake Ontario as a deep, slow-flowing stream, split in places into many channels by the Thousand Islands and other island groups. At a distance of 67 miles from the lake the first rapids are met, and rapids and swift water continue through the remaining 48 miles of the international border. The most spectacular of these rapids are the Long Sault, near the foot of the reach. Leaving the border, the river expands into the quiet water of Lake St. Francis, which extends for about 27 miles. The river then drops through a succession of rapids, 15 miles in length, to Lake St. Louis. Lake St. Louis is 15 miles in length. From the lake the river passes in a turbulent course some 10 miles to Montreal Harbor. The famous Lachine Rapids lie in this last section.

The enormous reservoir of the Great Lakes equalizes the flow of the St. Lawrence and gives it an unparalleled uniformity of discharge. The river has no floods and no low water. Except where winter ice jams back up its levels, the range between high and low water marks is but a few feet. The minimum recorded monthly mean flow of 174,200 cubic feet per second in the upper St. Lawrence would be a flood on the Colorado; the maximum flow of 318,000 cubic feet per second would be low water on the lower Mississippi. In comparison the outflow from the Ohio ranges from some 30,000 cubic feet per second to some 1,500,000 cubic feet per second between low water and flood.

The large dependable discharge of

the St. Lawrence gives the river its great power possibilities. Moreover, because the flow is uniform, the river is not an eroding and silt-bearing stream. Its course has long since adjusted itself to the flow which it carries, and consequently it runs as a clear blue stream between stable banks. Surveys of the bed made 50 years ago are still reliable. There will be no problem in the maintenance of channels in the river after they are once excavated.

There are consequences of the uniformity of flow which are not so fortunate. Since the river does not erode its bed and banks it has not cut itself a deep valley. It flows generally but little below the natural surface of the ground. Since there are no floods the land has long been occupied and improved almost to the waters' edge. The construction of dams, to convert the rapid sections of the river into ponds, for the joint benefit of navigation and of power, will cause, therefore, large overflow damages. While the compensation for such damages is a relatively small item of cost in any plan of improvement, there is, on sentimental grounds, a demand that flooding be reduced to the minimum consistent with the public benefits resulting therefrom.

Again, since there are no marked low-water seasons on the St. Lawrence, the unwatering of the foundations of dams and other structures in the river becomes a major engineering undertaking and adds greatly to the cost of the works.

An essential feature in the preparation of plans for the improvement of the St. Lawrence is a reliable knowledge of the foundation conditions for the various structures. The Joint Board of Engineers supplemented the information previously available by some 450 borings, many of which were cored well into rock. In addition a special

examination was made to verify the continuity of the rock under a proposed dam site at the Long Sault Rapids, where swift and broken water prevented the use of ordinary drilling methods. Shafts were sunk into rock on each shore, and from the bottom of these shafts horizontal diamond-drill borings were driven under the river bed. The results of all of these investigations show that suitable foundations are available for the various structures planned.

It is convenient to consider the St. Lawrence in five sections. Using the designations employed by the Joint Board of Engineers these are:

The Thousand Islands section, 67 miles in length, embracing the deep, slow-flowing part of the river from Lake Ontario to the first rapids.

The International Rapids section, 48 miles in length, embracing the rapids and swift water extending along the international boundary to Lake St. Francis.

The Lake St. Francis section, extending 26 miles to the end of deep water at the foot of that lake.

The Soulanges section, 18 miles in length, extending from deep water in Lake St. Francis to deep water at the head of Lake St. Louis.

The Lachine section, 23 miles in length, extending through Lake St. Louis and the rapids below them to Montreal harbor.

The improvement of the Thousand Islands section is solely a matter of removing certain dangerous rock reefs in the river, and of cutting back a few projecting points in the narrow parts of the channels between the islands, so as to afford safe and convenient navigation. The improvement of the Lake St. Francis section requires only the dredging of deep channels through shoals in the lake. Neither of these two sections offers any engineering com-

plications. The engineering aspects of the proposal lie in the improvement of the three rapid sections—the International, the Soulange and the Lachine.

There are two general methods for carrying navigation past each of these sections. One is to construct a lateral canal, with locks, and the other is to convert the rapids into a navigable reach by the construction of a dam or dams with locks and short canals to carry navigation past the dams.

The enlargement of the existing 14-foot lateral canals may be summarily dismissed. These canals are so laid out as to require some 25 lockages in the transit between Lake Ontario and Montreal. The delay incident to such a number of lockages in an improved canal is inadmissible. Moreover, the existing canals carry an important traffic and must be kept in operation until a new waterway is opened. Their enlargement under traffic would be most difficult and expensive, if not impossible.

A new lateral canal requires, on the St. Lawrence, a less expenditure of funds than the construction of a dam in the river, but it affords a link in the navigation route through which vessels must move at slow speed, one which is subject to blockage should a vessel ground in the canal, and a route which cannot be enlarged readily to meet growing demands of traffic. The pool formed by a dam will afford open and unrestricted navigation, decidedly superior to that afforded by a canal. The concentrated fall at the dam will afford the means for developing power from the flow of the river, the value of which is an offset to the increased cost of pool navigation.

#### POWER DEVELOPMENT AND IMPROVEMENT OF NAVIGATION

While, therefore, the plans presented by the Joint Board of Engineers were

prepared in accordance with the recognized principle that the interests of navigation on the St. Lawrence are paramount, yet the board found that the full observance of this principle does not interfere with the beneficial use of the flow of the river for power. On the contrary, the improvement of the rapid sections of the river for the joint benefit of navigation and power was found to afford, as a rule, much better navigation than could be secured by the improvement now economically justifiable in the interest of navigation alone.

The extent to which the development of power can be advantageously combined with the improvement of the river for navigation depends primarily on the rate at which power can be marketed. This is an economic question on which views may diverge quite widely. It is complicated by the economic policy entertained in Canada of restricting the export of power in order to stimulate the development of industries within her borders. The plans presented by the Joint Board provide for an initial power development in conjunction with navigation improvement which is based on conservative estimates of the rate at which power can be marketed under restrictions as to exportation. They provide however, for the eventual utilization of the complete power resources of the river.

A controlling limitation on the installation and operation of power plants on the St. Lawrence lies in the fact that any sensible hourly fluctuation in the volume of flow past Montreal is inadmissible from the standpoint of navigation in that port and in the channel from Montreal to the sea. Montreal is not a tidal port. The extreme low-water elevation of the water surface in the harbor is some 18 feet above sea level. The depths in the harbor are dependent upon the



slope of the river between Montreal and Quebec, where the river finally reaches sea level. This slope is in turn dependent upon the volume of the discharge of the St. Lawrence and of the Ottawa, which join near Montreal. A fluctuation of 10 per cent in the discharge of the St. Lawrence produces a change of about one foot in the water level of Montreal Harbor. The depths in the harbor and in the channel to the sea have been won by the expenditure of large sums for dredging, and no diminution in depth through the operation of up-river power plants would be tolerated. These plants cannot be designed and operated to secure the maximum use of water by fluctuating the hourly flow to meet the fluctuating power demand.

#### POWER PLANTS AND WINTER DISCHARGE CAPACITY

The design and construction of hydro-electric machinery has reached such a stage that the design of power plants to develop the large quantities of power available in the St. Lawrence offers no new problems. The power plants must, however, operate both winter and summer if the power is to have any economic value, and the winter operation affords an unusual problem on the St. Lawrence. The critical feature is the maintenance of the winter discharge capacity of the river without excessive loss of head from ice gorging.

The rapid sections of the river now run open during the winter, for the currents are so swift that an ice sheet cannot form over them. From the time that the water in the river reaches the freezing point, in late December or early January, until the end of the winter, these exposed reaches are steadily making ice in the form of frazil and anchor ice. Frazil ice forms as minute crystals in the water, anchor

ice as loose masses on the bed of the river, due to the loss of heat by radiation. The particles of frazil agglomerate in pans of soft, snow-like ice which float down the surface of the river; and the anchor ice when loosened by the heat of the sun rises to the surface and floats down in similar masses.

In the quiet water at the foot of each rapid section an ice cover forms early in the winter. The oncoming masses of slush ice pack against this until the sheet has progressed into currents so rapid that the slush is carried under the ice sheet, creating a hanging dam which gorges the river. The gorging causes a rise in the river surface which eventually permits the pack to extend upstream. The ice accumulations at the foot of the rapid reaches extend for miles at the end of winter, and raise the water level by from 10 to 30 feet.

In the present condition of the river, the ice packs at the foot of the rapid reaches never push their way so far upstream as to back up the water at the head of the reach. There is a free discharge at the head of each reach, and the flow down the river suffers only the minor retardation due to minor local ice obstruction.

The construction of a dam in any of the rapid reaches of the river will, in the general case, convert the downstream portion of the reach into a deep, slow-flowing pool, certain to freeze over early in the winter. The upper portion of the reach will necessarily remain open, because the water levels at the head of each of the three rapid sections cannot be raised sufficiently to prevent this condition without creating excessive flood damage. Any substantial raising of the water level at the head of the International Rapids section would flood out the cities on Lake Ontario; a raise of the water at the head of the Soulanges section would flood wide areas of the low-lying land



that borders Lake St. Francis; and a substantial raise at the head of the Lachine section would flood the suburbs of Montreal.

#### ENLARGING CHANNEL TO PREVENT GORGES

The situation to be met when a dam is built in the St. Lawrence is, therefore, the prevention of an ice gorge at the head of the frozen pool formed by the dam. It can be met by enlarging the river channel in the upper portion of the rapid section until the currents are reduced to so low a velocity that the oncoming slush ice formed in the part of the river which remains open will not be carried under the ice sheet, but will consolidate on the surface, extending the sheet upstream. The plans for power development prepared by the Joint Board of Engineers are based on enlarging the upper reaches of the rapid section by excavation where necessary to ensure, with the discharges that must be maintained in winter, current velocities so low as to effect this condition, except through short distances at the extreme upper end of the reach, where the remaining area of open water could not produce enough ice to be of consequence.

The excavation required to accomplish this result runs into large figures. The wide and deep channels necessary for the purpose will afford superior navigation, and will reduce the river slopes to a minimum, affording a maximum concentration of fall for power production. Their cost can, however, be justified only by considerations of winter power operation.

It may be observed that the condition described is due to the great volume of winter flow of the St. Lawrence as compared with the capacity of its natural channels. On the ordinary northern river the rise required to adjust the slopes to its winter regimen

is small in comparison with the rise during the spring floods, and does not have to be reckoned with in the development of power on the stream.

#### OTHER METHODS OF PREVENTING GORGES

Two other methods have been advanced for meeting the peculiar winter situation on the St. Lawrence. One of these is to build the dams at so low a height that the ponds will not freeze over. If, however, the water is raised by the dams sufficiently to make the river navigable for deep draft shipping, and to concentrate the fall for power development, the currents are necessarily reduced to a range sufficiently low to permit of the formation of an ice bridge across the stream under extreme weather conditions, but sufficiently high to convert this bridge into a hanging dam as soon as it has formed. The danger of the formation of an ice jam would always be present, and the consequences of its formation would be serious. Moreover, with the entire reach running open, the ice accumulating at the foot of the reach, as at present, would greatly reduce the head and the available power in winter.

A view has unfortunately gained wide credence that the formation of frazil ice is due to the agitation of the water in the rapids, and that if the river surface is raised sufficiently to produce a smooth flow, the amount of frazil will be greatly reduced, even if the river remain open in winter. It is an elementary principle of physics that the amount of ice formed is proportional to the amount of heat lost, and extensive measurements made by the Joint Board establish the fact that the winter heat losses from smooth flowing portions of the river are at substantially the same rate as from the portions broken by rapids.

An ice sheet over a ponded portion of

the river creates an insulating blanket which reduces the heat loss to a small figure; and the ice produced by this residual merely adds slightly to the thickness of the insulating blanket. Since there is no marked spring rise on the upper St. Lawrence, the spring break up of the ice sheet will occur quietly and will not give rise to the jams found on rivers in which the breakup is accompanied by a freshet discharge.

The studies made by the Joint Board show conclusively that the problem of winter power operation on the St. Lawrence can be best met by works designed to create an ice cover over the river.

A second method that has been proposed for meeting the peculiar winter conditions on the St. Lawrence is to construct the power dam to such height as will utilize a part only of the full available fall in the reach, reserving the remaining available fall, by means of a control structure at the head of the reach, to overcome the retardation created by winter gorging. An inherent difficulty with such a proposal is that it aggravates the condition that it is intended to remedy, because with the pool at a lower level, the length of the swifter running open river will necessarily be increased. Unless an ample margin of head is reserved, severe weather conditions might lead to its exhaustion before the end of winter. Works designed on this principle do not conserve the full value of the natural power resources of the river, and the cost of the control works is not substantially less than the cost of the channel enlargement designed to prevent the condition that the control works are intended to remedy.

The plans proposed by the Joint Board of Engineers are based on the foregoing considerations of the general problems involved.

#### PLANS FOR THE INTERNATIONAL RAPIDS SECTION

In the International Rapids section, extending 48 miles along the international border, the river has a total fall of 92 feet, a large part of which is concentrated in the Long Sault Rapids, near the foot of the reach. In this section the ponding of the river by a dam or dams, for the joint benefit of navigation and power, unquestionably affords the best method of development. The length of the section is such that a side canal for navigation would be extremely costly and would impose an unnecessary hindrance to shipping. A market exists in the United States for the prompt absorption of all the power attributed to it from the development. While the market for power in the Province of Ontario is less extensive, there is a present demand for at least some of the power that would be generated.

Two plans for improvement were prepared by the Board, both of which were designed to open this portion of the river to deep-draft navigation, to assure the fullest practicable utilization of the power resources of the river, and to secure dependable winter power operation. One of these plans proposed to convert the entire section into a single navigable pool by means of a single high dam and power houses, to be constructed at the foot of the reach, at Barnhart Island. This is designated the single-stage development. The second plan was for a two-stage development through the creation of an upper and a lower pool, the upper pool being formed by a dam and power house about midway through the reach, at Ogden Island, and the lower pool by a dam and power houses at Barnhart Island that would have 18 feet less height than in the single-stage development.

With the single-stage development, navigation would enter the pool through a free channel from the upper river, and would pass from the lower end of the pool through a short canal on the American shore, with two locks, into a channel leading to Lake St. Francis. With the two-stage development navigation would similarly enter the upper pool through a free channel, pass from the upper to the lower pool through a lock at the Ogden Island Dam, and from the lower pool through a canal with two locks to Lake St. Francis as in the single-stage plan. The two-stage development would therefore require one more lock than the single stage.

The computed head at the power houses in the single-stage development is 85 feet. It is expected that the increased resistance of the ice-covered pool, and of ice obstruction in the tail races, will reduce the head to about 75 feet in winter. The power houses are to be built to provide for the eventual installation of hydro-electric generating machinery with a capacity of 2,326,000 horsepower. This will utilize the mean discharge of the river.

With the two-stage plan the computed head at the upper power house at Ogden Island is 17 feet in summer and 12 feet in winter, at the lower power houses 67 feet in summer and 63 feet in winter. They are to be constructed for the eventual installation of 406,400 horsepower at the upper power house and 1,808,600 at the lower, a total of 2,215,000 horsepower.

The plans for the single-stage development include the provision of controlling gates at the head of the reach at Galop Island with a free navigable pass 450 feet in width. These gates will normally remain open.

The amount of channel enlargement required to assure satisfactory winter operation cannot be predicted in ad-

vance with certainty. It is proposed to execute initially only such enlargement as is necessary to insure satisfactory navigation conditions and to prosecute this enlargement after the pool has been created, when dredging can be done more advantageously, until satisfactory winter operation is secured. The control of the head through the section afforded by the control gates at the Galop will afford a means for insuring the winter discharge capacity of the river during this period.

The estimated cost of the single-stage development, including the eventual enlargement of the channels to the extent foreseen as necessary to assure winter operation, and the eventual installation of hydroelectric generating machinery to the full power-house capacity is \$235,000,000. This includes compensation for 22,000 acres of land that would be inundated by the execution of the project and for all damages related thereto. The estimated cost of the two-stage development, similarly complete, is \$264,500,000. The area inundated would be 12,000 acres.

The United States Section of the Joint Board recommended the single-stage development as affording better navigation through the elimination of one lock, and slightly more power, at a cost of \$29,600,000 less than the cost of a two-stage development.

The Canadian Section of the board recommended the two-stage development on the ground that it can be carried out in two parts, so that power from the upper development can be developed and marketed before the whole of the project is completed. It believed that for this reason the overall cost, including interest charges, will not be as greatly in excess of the single-stage development as appears from the comparative costs without interest charges. It believed that

control over the flow of the river would be better assured. Flowage of land would be reduced as has been indicated.

Studies made by the Canadian Section subsequent to the submission of the report have lead it to prefer a two-stage project with the upper dam about 7 miles farther downstream, at Crysler Island. The lower pool would be at an elevation 7 feet below that proposed in the former project, affording a much more favorable head at the upper power house. The estimated cost of this modified two-stage project is \$269,355,000, or about \$5,000,000 in excess of the project with the upper dam at Ogden Island, and flooding damages are somewhat increased. The number of locks remains the same. Its advantage lies in the better power operating conditions afforded by the increased head at the power house of the upper dam.

It may be observed that the construction of both dams of the two-stage development, with connected power-house substructures, is necessary before navigation can be opened through the reach.

In this section the paramount interest of navigation is overshadowed by the large expenditures required for power development. The cost of the locks and their approaches and other works requisite only for navigation is but about \$25,000,000 with the single-stage development, or about \$33,000,000 with the two-stage. The remaining sums are required for power development whether or not navigation is provided. It is to be anticipated, therefore, that the arrangements made for financing the power development will determine the choice of the plan eventually selected.

#### THE SOULANGES SECTION

In the Soulanges section, extending 18 miles from Lake St. Francis to Lake

St. Louis, there is a total fall of about 83 feet. At the Cedars Rapids, midway in the section, an existing and quite modern power plant diverts about one-third of the river flow and develops power with about 32-foot head.

While the probable lack of market indicates that the immediate complete development of the power in this section in conjunction with navigation improvements would not be economically justifiable, the Joint Board of Engineers found it to be practicable and advantageous to combine the improvement for navigation with the development of power on a progressive program of construction of power plants, only the first part of the power development being undertaken in conjunction with the works required to carry navigation through the section.

This plan provides for the construction of a dam and power houses at the head of the Cedar Rapids, which would create a navigable pool in the upper part of the section, and would afford a head of 22 feet. Navigation would enter this pool from Lake St. Francis through a canal, 3 miles in length with one low lift lock, and would pass from the pool to Lake St. Louis through a second canal, 5 miles in length, with two lift locks.

The estimated cost of this initial development, including the development of 382,000 horsepower at the power houses, is \$104,000,000. The eventual development of the remaining available power, in part by a head-race canal to the escarpment at Lake St. Louis and in part by a second dam and power house at the foot of the section, is \$101,000,000. The total installed hydroelectric generating machinery in the eventual complete development would have a capacity of about 2,000,000 horsepower.

A comprehensive scheme for the



immediate development of the entire power resources of the river, and the utilization of the entire river course for navigation, by the construction of two dams which would convert the river into two navigable pools, was found to cost \$10,000,000 less than the eventual cost of the successive power development with the plans recommended. It was regarded as meriting serious consideration if a market for the large amount of power can be found within a reasonable period.

The Joint Board of Engineers united in the view that the plan first outlined better provides for the present and future development of the waterway than any scheme for navigation alone, and is therefore the desirable plan, if arrangements are made whereby power interests bear a fair proportion of the initial expenditure required.

If it be found impossible to arrange for such coöperation in meeting the initial cost, a majority of the Canadian Section of the Board favored the construction of a lateral canal for navigation on the south side of the river, at an estimated cost of \$33,640,000. It would be about 15 miles in length from shore to shore. A canal can be built in this location at the least cost, but no part of the canal can be subsequently incorporated in a development of the river channels for navigation. The United States Section submitted the view that a route designed to serve so large a territory will demand eventually the freer navigation of the open river. It believed, therefore, that even if arrangements cannot be made for the participation of power development in the initial development, it would be better to proceed on the plans laid out for this development, limiting the construction of the power houses to the substructures. The cost, when so curtailed, would be \$78,515,000. As

an alternative the United States Section suggested a canal on the north side of the river, at a cost of \$40,378,000, most of which could be utilized in connection with a subsequent development of the river channel.

#### PLANS FOR THE LACHINE SECTION

The remaining section for consideration is the Lachine section, which includes Lake St. Louis and the 10 miles of rapids, swift water and shoals between that lake and Montreal Harbor. In this section, the first 11 miles through Lake St. Louis are in deep water, the remaining 4 miles are through the shoal water at its foot. The total fall through the section is 48 feet, of which 24 feet is the fall through the Lachine Rapids.

The winter rise in and above Montreal Harbor, due to the accumulation of ice, reduces the total fall to about 30 feet.

The Joint Board of Engineers found that in this section it was not feasible to utilize any part river channel below Lake St. Louis for navigation without an excessive amount of costly excavation, on account of the high current velocities in this contracted section of the river even when raised to its highest practicable level. It found, therefore, that a side canal affords the most suitable route for navigation between Lake St. Louis and Montreal Harbor.

The route selected for the side canal follows close to the river bank in order that it will not interfere with the future growth of the city of Montreal and will not introduce the difficult problem inherent to the crossing of land and water traffic, with the consequent inconvenience and delay to both. It has three lift locks and a guard gate.

The city of Montreal lies on an island at the confluence of the St. Lawrence and the Ottawa. A part of the discharge of the Ottawa is delivered into



Lake St. Louis above the city, and a part flows north of the city, joining the St. Lawrence at the foot of the island on which the city lies. On account of the widely varying flow of the Ottawa, there is a range of about 8 feet in the levels of Lake St. Louis. In order to reduce the excavation of the upper level of the navigation canal and of the channel required through the long shoal at the foot of the lake, the plans include the construction of a control dam in the river below the lake, by which the levels of the lake can be held up during the navigation season. Flood discharges will be passed through the dam. The plans provide for a dam of the rolling shutter type, which will be entirely opened in winter, so that the winter regimen of the river will not be changed. Supplemental control works are required in the other outlets of the Ottawa to preserve the present proportional flow past Montreal during the low-water season. The cost of the entire system of control works is about \$2,000,000 in excess of the saving in excavation costs which they effect, but these works will reduce the cost of any future development of power at the Lachine Rapids, besides being of benefit to local navigation on the lake. The entire cost of the improvements proposed in this section is \$53,000,000. They are coördinated with the future development of the full power resources of the section.

The plans that have been described for the improvement of the various sections of the river provide for channels which can eventually be enlarged to a depth of 30 feet, the lock sills and other fixed structures being designed for that depth. The estimates that have been given are for an initial excavation of the channels to a minimum depth of 25 feet, which will be suitable for navigation by vessels not exceeding 23 feet salt-water draft. The total esti-

mated cost of the entire improvement of the St. Lawrence between Lake Ontario and Montreal, including the installation of hydroelectric power generating machinery to the full capacity of the power houses of the power developments initially proposed, with the channels initially excavated to a depth of 25 feet, is from approximately \$394,000,000 to \$428,000,000 depending upon the form of improvement adopted in the International Rapids section. This includes the cost of power works with an installed capacity of from 2,730,000 horsepower to 2,619,000 horsepower, the value of which can be conservatively placed at between \$250,000,000 and \$300,000,000.

The added cost of providing initially channels 27 feet in depth is estimated at \$5,800,000. The reduction in cost if channels 23 feet in depth are initially provided is estimated at \$5,300,000. It may be observed that the broad economic question of the depth that should be provided initially rests on the cost of the requisite deepening of the interconnecting channels and the harbors on the Great Lakes to derive the benefit from the waterway.

It is to be borne in mind that the draft of a vessel must be less than the channel depths. Channels 23 feet in depth are suitable for the navigation of vessels not to exceed 21 feet salt-water draft; channels of 25 feet depth for vessels not exceeding 23 feet salt-water draft, and channels 27 feet depth for vessels of 25 feet salt-water draft. For vessels of the size of those that would use the proposed St. Lawrence Waterway, the fresh-water draft exceeds the salt-water draft by from 6 to 7 inches.

The plans which have been described provide for a navigation route from Lake Ontario to Montreal Harbor with a total not to exceed 25 miles of restricted canal navigation and with

not more than nine locks. It will be crossed by but eight bridges. The capacity of the waterway is estimated at 24,000,000 tons per annum.

A commission headed by the Hon. Herbert Hoover, which was appointed by the President of the United States to advise on the development of a shipway from the Great Lakes to the sea, received for the United States the report of the Joint Board of Engineers. Their conclusions are as follows:

First. The construction of the shipway from the Great Lakes to the sea is imperative both for the relief and for the future development of a vast area in the interior of the continent.

Second. The shipway should be constructed on the St. Lawrence route, provided suitable agreement can be made for its joint undertaking with the Dominion of Canada.

Third. That the development of the power resources of the St. Lawrence should be undertaken by appropriate agencies.

Fourth. That negotiations should be entered into with Canada in an endeavor to arrive at agreement upon all these subjects. In such negotiations the United States should recognize the proper relations of New York to the power development in the International Section.

The report of the Joint Board of Engineers advances the consideration of the proposal to the stage at which it becomes a problem of statesmanship. There can be no question of the practicability of the proposal from an engineering standpoint after the international, financial and economic questions in connection with the work have been determined upon.

# What the St. Lawrence Waterway Means to the United States

By W. L. HARDING

President, Great Lakes-St. Lawrence Tidewater Association

THE demand throughout the west for a ship channel outlet from the Great Lakes to the Atlantic Ocean, by way of the St. Lawrence, rests upon the need of that region for more direct and cheaper connection with the markets of the world, and also upon the physical make-up of the North American continent, which lends itself, by reason of the location, depth, and breadth of the Great Lakes and St. Lawrence River, to such a connection—a connection that would give to the North American continent, a fourth ocean, its shores reaching to the borders of the harvest fields of the Middle West, now removed a thousand miles and more from contact with the sea.

On no other continent has civilization entrenched itself at any considerable distance from the ocean. On this continent alone it has done so under conditions that do not assure its continuance, unless the transportation handicap that distance from the sea always and everywhere involves be removed.

The North American mid-continent was claimed for civilization under peculiar conditions. The movement from the Atlantic over the mountains and into the plains beyond began before the days of the steamboat or of the railroad, and when the tools of industry and agriculture were for the most part as crude as they were in the days of Caesar. Not even the plow was yet an efficient tool, and the grain drill, the binder, the threshing machine were all unknown. The agriculture of western European lands was settled in

its ways, and that of our now great competitors—Argentina, Australia, Russia—was not a factor in world trade—in fact, did not cast a shadow over the future.

We invented the steamboat, we adapted the railroad, we improved the plow, we invented the reaper, the grain drill, the threshing machine and the modern binder, and we developed, ahead of any other nation, all of these things and put them to our purpose of subduing a continent.

By the most ingenious system of bonuses ever known to history, we invited the pioneers of three generations to put the lands of the interior under cultivation—lands that, for the larger part were level, treeless and rich and that made our quick results of large acreage under the plow and large production possible.

We financed our wars out of these lands. We held out to our farmers as a reward for their labor, not a fair return in cash for the crops harvested, but an increasing equity in the lands themselves, as the country might settle up and the value of the lands might increase.

The network of our railroads spread over the interior and on to the Pacific. The iron ores of Minnesota, the copper of Michigan and of Montana, the output of the smelters in the Rockies was added to the golden harvest of the farmers. The inland ocean of the Great Lakes became busy with a water-borne commerce that told of the rising greatness of Buffalo, Toledo, Cleveland, Detroit, Milwaukee, Du-

luth-Superior, Chicago and other thriving harbors.

The great cities of the prairies were called into being. The packing business moved westward from Cincinnati, and the day of the open ranges began. The prairie states of the Middle West settled into their agricultural stride.

Then our factories carried the plow, the binder, the thresher to other and new lands, agriculturally speaking—to the Argentine, to Australia, to Russia—all lying close to the sea, all able to ship from the farm to the market in Europe for less money than we can possibly hope to—unless a way can be found to move our farm lands closer to the ocean.

Our three great advantages—lands cheaply acquired, easily tilled, and stored with a wealth of bankable fertility—made possible the civilization that is now ours in the Middle West; these, coupled with the fact that we had no large or active competition in the market places of the world.

We now have that competition. It is here to stay. It will increase, rather than diminish, with the passing of time. New areas, outside of this continent, and fit for agriculture, will develop and become competitors of ours, with whom we must in all the future years do a competitive business.

For the major portion of the things the Middle West produces, the world's market place is Europe. Europe is where the consumers are—Western Europe, the Baltic, the Mediterranean. The people of the Atlantic Coast cities are fed in good part by the farmers of the east—by the farmers westward to the Mississippi. And the farmers of the trans-Mississippi region are thrown back upon the European market with their surplus—with the surplus which we as a nation need to continue and will continue to produce in order that at all

times we may have plenty for ourselves.

#### EXCEEDS DOMESTIC NEEDS

The transportation-handicapped region of the United States is neither small in producing power nor is its production going to cease. This region possesses 63 per cent of the dairy cows, 55 per cent of other cattle, 75 per cent of the hogs, 76 per cent of the sheep, 61 per cent of the horses and 63 per cent of the total live stock value of the United States, as estimated by the United States Department of Agriculture. Of the edible crops—that is, excluding flax, tobacco and cotton—the transportation marooned area produces approximately 60 per cent. And except for the South, when the area of farm acreage expansion is considerable, the marooned area under discussion holds the reserve high grade agricultural lands of the nation.

Taking the national resources that are non-agricultural, the transportation-locked area leads in hydro-electric power with approximately 50 per cent of the potential supply of the United States. This region contains our future supply of coal and of petroleum; here are our copper and lead and iron supplies both of today and for the years to come. These unused and tangible resources point to expansion in the future, conditioned only upon the access of the Middle West to the markets of the world on an even footing.

The point, without being too dry-as-dust statistical, is that the transportation-handicapped area within the United States is producing now, and can and will expand its production in the future well beyond any present or near future home consumption requirements.

#### CONTINUING INTERNATIONAL TRADE

According to the United States official figures for 1922, the average per

capita wealth of the marooned area is \$3553. The average per capita wealth of the entire United States was, for that year, \$2918. This can mean nothing else than that, both in producing and consuming power, the area in question, with its 45,000,000 people, carries its share of the load of foreign commerce, both going and coming. That commerce amounted, in 1924, in goods sent and received overseas, to 80,514,000 long tons, of which the marooned area's equitable portion, produced or consumed, would be 40 per cent, or 32,000,000 tons.

That, however, is not the yardstick by which to measure the need of the American interior for better transportation. That estimate is arrived at by detailed studies of all lines of production. It is worth while to consider whether any people engaged in the wholesale production of crude and bulky materials such as grain, foods, ores and the like will ever cease very largely to produce those things, or other things comparable in tonnage.

For example, contrary to popular opinion, the percentage and the volume of wheat exports from the United States have not decreased with the passing years. From 1866 forward the largest per cent of any wheat crop shipped abroad was during the period 1876-1906, during which time we exported an annual average of 30 per cent of our crop. In 1922 we exported 25.6 per cent; in 1923 we shipped out 19.9 per cent and in 1924 our shipments reached 28.8 per cent. The bushel figures are even more striking, showing that right now, in these post war years, the American farmer is maintaining his production and his exports of wheat well above the levels of the pre-war years. Today the wheat acreage of the nation is again expanding. And if the farmer of a coming generation chooses to abandon

wheat it will be in order that he may produce other bulky foods, that, like wheat, create tonnage and invite tonnage in return. And it will be for the obvious reason that the production of these other things will be more profitable to him, and will make of him a more important trade-load factor. As an example the farmer has ceased to export flax. What is the result? The nation imports flax—ships it inland to the linseed mills situated on Lake Erie and at Minneapolis. Little, if any, tonnage of flax movement has been lost, and the erstwhile flax farmer is growing other tonnage and making crops more profitable. The result is a net gain in tonnage. The idea of a vanishing export tonnage from the interior and to the interior of the continent is a myth.

#### ENHANCES NATIONAL ECONOMY

Of the 80,000,000 long tons comprising the total 1924 overseas commerce of the United States 43,000,000 moved out of or into the ports of the North Atlantic, 23,000,000 by way of the Gulf of Mexico, 12,000,000 out of and into our Pacific harbors, and the balance from the South Atlantic ports. In addition to this there was a Great Lakes total movement to and from Canada amounting to 15,500,000 tons. These figures will indicate, to some extent at least, the general directions taken by our commerce in seeking outlet to the sea. They parallel the rail and water movements throughout the country, and they cast a side light upon the fact, already mentioned, that Europe is by far our largest customer, especially for those products that are essentially mid-western in origin, such as grain, food products, and the fabricated products of iron, copper, etc.

The transportation handicap which this interior commerce is under when moving into world trade is measurable.



The difference between the existing rate by rail to the Great Lakes, thence by water to Buffalo, by rail from Buffalo to New York, and from New York by ship to Liverpool, and a fair transportation charge for same cargo moving by rail to the Great Lakes and by water direct to Liverpool is set, by Alfred H. Ritter, Transportation Specialist of the War Department at a minimum of \$4.00 per ton in favor of the St. Lawrence route, assuming that ships of ocean draft could ascend into the upper Great Lakes with, and for cargo.

The report of the President's Advisory Committee, the St. Lawrence Commission of the United States of which the Hon. Herbert Hoover is chairman, estimates that at present there is available for movement over this waterway 23,000,000 tons of cargo. This Commission states that,

It has been estimated that the values in a single year to the farmers alone would equal the capital cost (\$123,500,000) of the waterway.

But in considering the question of possible tonnage a larger aspect of the problem should not be forgotten. A major transportation route not only fixes the rates chargeable by secondary routes, but it also fixes basic price levels throughout the area of its influence. Today the price of wheat in the mid-continent of North America is determined by the world market price, *less* the cost of transportation. Cut the transportation charge and you do not benefit the buyer. His requirements and market supply remain as before—the saving reflects back to the shipper, and the farm price levels advance on *all* wheat sold, both for local consumption and for export.

An illustration may serve to make this point clear.

A farmer sells grain to a local miller.

The price he receives will be based on the local price for grain, which in turn is based on Liverpool, minus the total freight, from his station to that terminal market. It is obvious that, in this instance, the farmer, whose grain is ground into flour at the local mill, *actually pays freight on his wheat to Liverpool*. And whatever lowering of the freight rate may be obtained by opening the Great Lakes to Ocean commerce, will benefit that farmer to the same extent as it will benefit the man whose wheat crosses the ocean.

This principle of local price control through the establishment of low cost transportation to the ultimate market holds true for barley and for corn and lard, and for bacon and for lumber and copper and wooden ware and steel safes and machinery and clothing, for automobiles and for all the multitude of things produced or used by and in the mid-region. Today the Great Lakes-Ocean trunk line that runs via Buffalo and New York sets the price levels. Open a wider, better path—an adequate path—and every business, and not the farmer alone, must and will benefit thereby.

The foregoing estimates of tonnage and of saving thereon, using Alfred H. Ritter's figures, indicate an annual direct overcharge on actual movement out of and into the freight-handicapped mid-region amounting annually to \$120,000,000. Nor does this take into account the unseen charge, by way of depressed price levels, on things produced but not exported. One hundred and twenty million dollars is interest, at 4 per cent, on \$3,000,000,000. This figure is arrived at merely as suggesting that a reasonable expenditure of public money so used so to turn this capital value into productive channels may be justified on broad grounds of national economy.

By their official action twenty-two

states have severally and jointly approved the opening of the St. Lawrence barriers between the Great Lakes and the Atlantic. These states comprise what is known as the Great Lakes-St. Lawrence Tidewater Association. It should be clearly understood that the purpose of these states is not to reach any one point on the Atlantic, but rather to reach the ocean itself. They are not looking for a way to New York, only as and insofar as New York is one of the port cities of the world. The marooned interior comprising these states is looking for a trade road to *all* the world—not for a detour, nor for a half-way depot. It seeks a trunk line out of the Great Lakes and onto the high seas. Once there it can steer its course to the most desirable market.

A glance at a globe of the world will make clear the reasons for this determination. From the dawn of history until today, sea routes have controlled the world's trade. They still do. They always will. The reason is simple. Water transportation is far cheaper than transportation by land. Today, steamship against freight car, the cost is about one to ten. The cost of one mile of land transportation buys ten miles of ocean transportation.

And within the memory of men we have remade the map of the world. We have cut the isthmus of Suez and brought India, China, Japan, Australia the eastern coast of Africa thousands of sea miles closer than ever before to the doorstep of our principal buyer—Europe. We have cut the isthmus of Panama and once more we have floated the continents closer together. By building the Panama Canal we have put Calgary and Seattle closer to Europe by way of the Pacific and the Caribbean than they are by way of the direct rising sun and Atlantic road. And of still deeper, more direct and vital concern to the interior of this con-

tinent, the building of the Panama performed the miracle of bringing San Francisco and New York—the Pacific coast and the Atlantic—closer to each other than either city or either coast is to any inland point five hundred miles removed from the ocean. This has landlocked the interior of the North American continent. While our sea-coasts move forward under the stimulus of lowered sea rates and active participation in world trade, the interior finds its transportation rates to and from the sea advanced, its competitors in other lands able, by reason of short land haul, to meet world conditions and prices that deny to the mid-section of North America its place in the world's markets—unless we finish the job of world rebuilding along lines obviously pointed out to us by nature.

The world is round. The eastern coast of the United States points not toward the North Pole, but toward Europe. So do the Great Lakes and St. Lawrence River. For two thousand miles this natural highway parallels the Atlantic coast. The Great Lakes, carrying a commerce equal to more than one-fourth the ton mileage of all the railroads within the United States, are open to ships of ordinary ocean draft and tonnage from Duluth and Chicago to Buffalo. Their channels are wide, their harbors ample, they are, in fact, an ocean extending a thousand miles along our northern border, linking the coal fields and the iron mines, linking the corn belt and the grain fields with the industrial East. Across the Niagara isthmus, the Welland Ship Canal is nearly ready to take the largest Great Lakes ships and let them down into Lake Ontario, where from the foot of the Welland Ship Canal, now nearing completion, to Ogdensburg on the St. Lawrence is deep water. From Montreal, the second largest port of the Atlantic

seaboard, to Liverpool and to all western and southern Europe the sea lanes are wide open. Five thousand miles of sea channel extend from Duluth and Chicago to Liverpool and points beyond, and all accounted for as deep, wide, free navigation adapted to ocean-going shipping, except twenty-five miles. That is the picture the ship captains see. That is the picture the Joint Board of Army Engineers of two nations paints for us. That is what the mid-continent has to start with when it demands a sea-road to Europe.

The engineering problems involved do not properly belong to this discussion. It may suffice to say that, not without thought, not without full examination into any and all routes, and with a complete knowledge of what the engineers of both nations had already done, was the choice of the marooned interior fixed upon the St. Lawrence as the only practical route to the sea.

Not only was the fact that the St. Lawrence route is a "going concern" taken into account, but also the fact that the numerous surveys of that route and other routes plainly indicated its preferability to the continental interior for the purpose of establishing an unrestricted thoroughfare to the world bordering upon the high seas. The Associated States rest their case as to the engineering feasibility of the route chosen upon the decision of the Joint American-Canadian Board of Engineers, in two reports.

The basic engineering facts are well known. Time required, lift, restriction of traffic, cost—all these things more closely computed by the Joint Board of Canadian and American Engineers that surveyed the St. Lawrence route in 1920-21, and again in 1925-26.

There is no alternative route. There is no other sea road to and from the industrial and agricultural empire westward of the Appalachians. Rivers that carry us to the sea, canals that climb the hills—these may serve a useful purpose in the quickening of our transportation circulation, but they are, at their ultimate best, but highways leading down to the ocean. And when one takes to a highway he will, if he is wise, choose one that leads toward his destination. The Great Lakes are in themselves an ocean. The St. Lawrence is a strait. Across the seas that send their tides a thousand miles up its broad bosom is the great market place of the world. There the mid-continent buys and there the mid-continent sells, and between Duluth and Liverpool, between Chicago and the Baltic, between Detroit, and Marseilles lie today two great barriers—one of rock, that can be measured, drilled, blasted until the waters run deep and free, until the ships can go out and in.

The other barrier is that of misunderstanding as to need and purpose. And it, too, bearing in mind the history of this America of ours, is removable.

## The Economic and National Significance of Connecting the Great Lakes with the Sea by the St. Lawrence Route

By HON. I. L. LENROOT  
United States Senator, Wisconsin

I HAVE been asked to discuss the economic and national significance of connecting the Great Lakes with the sea, by the St. Lawrence route.

Speaking first of its national significance, it is demanded by 40,000,000 of our people in the West, more than one-third of our population, because of the economic benefits that will result in bringing the Atlantic Ocean to the heart of the continent, and making ocean ports of all of our cities upon the Great Lakes. It is also demanded by a large majority of the people of our New England States because of transportation benefits and the cheap power that will be developed for their use, which will remove one of the most serious handicaps to the continued existence of their industries.

The history of the idea of connecting the Great Lakes with the sea is most interesting. It has been a dream of many years, almost since the Republic was founded, and its history is not so dissimilar to the history of the Panama Canal. It may not be generally known that the first project for connecting the Great Lakes with the sea was inaugurated by George Washington. In 1792 he obtained the passage of an Act of Incorporation by the Legislature of the State of New York for the construction of a waterway between the Hudson River and Lake Erie by a system of canals and slack water and lake navigation by way of the Mohawk River, Oneida Lake and River, and Oswego Lake and Ontario. Of course, Wash-

ington little dreamed of the leviathans of the deep that we have in our day. As we all know, canals have been constructed. We have today the Erie Canal, but it does not permit the passage of ocean-going vessels into the Lakes, and although the State of New York has expended more than \$200,000,000 upon this project, it has proved to be a colossal failure, and Government boards, one after another, engineering and otherwise, have reported that it is not practical, except at a prohibitive cost, to construct a canal between the Great Lakes and the Hudson River, that will admit ocean-going vessels to the Lakes.

Twenty-two states have joined in an association, known as the Great Lakes-St. Lawrence Tidewater Association, to promote the St. Lawrence route, the governors of each being *ex-officio* a member of the Council of States directing the activities of the Association. The mere recital of the names of the states indicates the national character of the organization. They are Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Colorado, Wyoming, Montana, Idaho, Utah, Washington, Oregon, South Carolina, West Virginia, and Kentucky. Its Executive Director is Charles P. Craig, of Duluth, with headquarters at Washington.

The International Joint Commission, a permanent official body consisting of three persons appointed by



the President of the United States, and three persons appointed by the Government of the Dominion of Canada, in 1922 made a report upon this subject unanimously recommending the St. Lawrence route. They said:

The conclusion is obvious that if countries that had for the most part to import their raw materials from abroad were able to build up a great foreign trade because of their ready access to the sea, the region economically tributary to the Great Lakes, with its limitless resources, its raw materials within easy reach, its facilities for industrial expansion, can hardly fail to become an even greater factor in the world's markets than it is today, if given a practical and efficient water route to the sea.

On March 14, 1924, President Coolidge appointed a commission with Hon. Herbert Hoover, Secretary of Commerce, as chairman, to make a further study of the subject. On December 27, 1926, it made its report unanimously recommending the St. Lawrence route. I quote from its report:

The construction of a shipway of sufficient depth to admit ocean-going shipping from the Atlantic to the Great Lakes will lessen the economic handicaps of adverse transportation costs of a vast area in the interior of the continent. Within the United States it embraces all or large portions of the states of Ohio, Indiana, Kentucky, Illinois, Iowa, Missouri, Kansas, Nebraska, North and South Dakota, Montana, Wisconsin, Minnesota, Michigan, Pennsylvania and New York. It includes a large part of Canada. Within this area there are more than 40,000,000 inhabitants who gain their livelihood from its basic industries. It produces a vast surplus both from agriculture and manufactures, much of which demands long transportation. . . . It has been estimated that the values in a single year to the farmers alone would equal the capital cost of the waterway. . . .

The interior states which are affected by this situation have not been neglectful of the benefits to be derived by the bringing to them of ship transportation to the sea.

Eighteen of them have associated together by acts of their legislatures, under the name of the Great Lakes-St. Lawrence Tidewater Association. They represent nearly two-fifths of our population. They have made their own independent investigation and have concluded and declared that the opening of the Great Lakes to ocean-going vessels through the St. Lawrence is a major public necessity in the economic interest of their communities.

The Commission further stated that:

The construction of the shipway from the Great Lakes to the sea is imperative both for the relief and for the future development of a vast area in the interior of the continent.

The shipway should be constructed on the St. Lawrence route, provided suitable agreement can be made for its joint undertaking with the Dominion of Canada.

Of its benefit to the entire nation, the Commission said:

In the wider view, the increased prosperity of the mid-continent, the relief of many of their present economic difficulties, and development of huge water power for stimulation of industry and commerce in New England shall add to the prosperity of the country as a whole and thereby benefit every citizen and every city.

A New England committee, consisting of prominent citizens of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut, of which Col. Charles R. Gow of Boston is chairman, has made a study of the subject, and a few months ago made a report unanimously recommending the St. Lawrence route. I quote from its conclusions:

It is our belief that a reduction in transportation costs is the primary requisite of the central section of the country today and that its accomplishment would afford more real relief to the farming and other elements of that community than would any of the proposals which so far have been advanced for the proposed amelioration of the farmers' condition.



Every impartial body that has studied this subject has recommended the St. Lawrence Waterway as a great national undertaking of great national benefit. The only opposition comes from the State of New York, and that state is not unanimous in its opposition. A large part of northern New York is enthusiastically in favor of the project. The opposition is selfish, fearing that the commerce of the cities of New York and Buffalo will be injured by the project. It is hard to believe that the intelligent patriotic citizens of that great state when they fully understand the question will be in favor of compelling the distressed farmers of the West to pay a wholly unnecessary toll to the cities of New York and Buffalo solely for their benefit.

#### THE ECONOMIC SIGNIFICANCE OF THE ST. LAWRENCE ROUTE

That our farmers of the West have ever since 1920 been in great financial distress we all know. That they have for years been demanding from the Congress relief from their economic condition we also know. In their dire need for relief many of them have become the innocent victims of designing politicians who make impossible promises to them, and propose remedies that cannot stand either the test of constitutional authority or common sense.

Because these things are so should not cause us to fail to realize that our farmers are suffering under a great economic handicap, and because most of the plans that are proposed for relief are impracticable or unconstitutional should not cause us to take the position that there is nothing the Government can do for them. We are living in an age of organization. Manufacturing is organized; finance is organized; labor is organized; mining is organized; but our farmers are not organized. The farmer is essentially an individualist and the

agricultural industry does not lend itself to either the corporate form of manufacturing or the association form of labor. The coöperative organization is the only practical form open to the farmer, and such organization as to a staple product produced generally throughout the country is very difficult. The result is that he finds himself paying high prices for everything he has to buy, produced under conditions that prevent excessive surpluses.

The farmer, however, goes right on producing crops greater than domestic consumption can care for, and he has a surplus which must find a market abroad. In such cases he receives very little benefit from tariff rates, and he therefore buys in a high market and sells in a low market. In wheat, especially, he gets as a rule the Liverpool price, less the cost of transporting his wheat from his railroad station to Liverpool, and thus the price is fixed, not only for wheat that he ships to Liverpool, but also for the wheat that he sells to be consumed in the United States. The farmer, also, pays the transportation rate upon everything that he buys. If he buys a Ford car he pays the Detroit price plus the transportation rate to his nearest railway station. If he buys a piece of agricultural machinery he pays the factory price, plus the transportation rate to his town, and so with all his other purchases. The farmer is the only American engaged in industry who pays the transportation upon both what he buys and sells. It is for this reason that the farmers of the West, far from markets, are constantly clamoring for lower transportation rates, and often demand such low railroad rates that if granted would throw every railroad serving them into bankruptcy. True, most of the farmers' troubles are economic, beyond relief at the hands of the Government, but this makes it all the more

necessary that when the Government can give him real assistance that is sound, and rational, it should do so without any delay. When it can lower his transportation costs without injustice to anyone it should not hesitate to do so. The St. Lawrence Waterway furnishes this opportunity. Mr. Alfred H. Ritter, Transportation and Expert Specialist, has written a book upon this subject embodying the results of his studies of the transportation economics of the St. Lawrence project. He estimates the saving to the farmer in transportation rates upon grain to be about ten cents per bushel. He states that the average export movement of United States grain from Atlantic seaboard and St. Lawrence ports for the years 1921 to 1923 averaged 192,000,000 bushels, and upon this alone our farmers would have saved nearly \$20,000,000 a year if they could have used the St. Lawrence Waterway. He also estimates there would be a general enhancement in price of five cents per bushel generally. Upon the last page of his book, under the Title "Conclusions," Mr. Ritter says:

The probable transportation savings on grain alone are equal to five per cent on \$800,000,000, while the annual transportation savings plus farm price enhancement are estimated to equal or exceed the total expense of the improvement properly chargeable to navigation, under the original project submitted to Congress by the International Joint Commission.

But it is not grain alone that will be transported over this waterway at a great saving of transportation costs.

The flour mills of Minneapolis in 1922 exported 659,000 barrels of flour. Mr. Ritter estimates that the St. Lawrence Waterway will effect a saving of \$6 per long ton on flour shipped from Minneapolis to Europe.

Our packing house exports now amount to more than 2,000,000,000

pounds annually. Seventy-three per cent of this, or 1,560,000,000 pounds, originate in the territory tributary to the Great Lakes. Mr. Ritter estimates that upon shipments of these products from Chicago to London the St. Lawrence route will effect a saving of \$17 per ton in transportation cost.

The heart of the automobile industry of the world is situated upon the Great Lakes. Exports of automobiles are increasing every year. The rail rate to the seaboard is high. It is estimated that over 115,000 tons of automobiles will be exported annually over the St. Lawrence route. I might name iron and steel products, agricultural implements, and many other commodities produced in territory tributary to the Great Lakes.

Thus far, I have spoken only of exports of commodities produced in Great Lakes territory, but imports of commodities used in this territory could also be carried over this waterway at a great saving of transportation costs. One of the most important of these is rubber. Our imports of rubber amount to more than 300,000 tons annually. Sixty-one per cent of the rubber imported is used by manufacturers tributary to the Great Lakes. This amounts to about 200,000 tons annually that could be carried over the St. Lawrence route, and Mr. Ritter estimates that this will effect a saving of more than \$5 per ton in transportation costs, or more than \$1,000,000 annually. This saving will effect every user of automobiles in the United States.

For the immediate territory affected imports of sugar will be the most important. The Great Lakes territory produces about 900,000 tons of beet sugar annually. The people of this territory consume about 1,800,000 tons annually, thus making necessary imports of 900,000 tons for their use annually. Every ton of this could come

over the St. Lawrence route at an estimated saving of transportation costs of from \$6 to \$13 per ton. In addition there will be imports over this route of fish, rice, tropical fruits and nuts, wood pulp, manganese, etc., and other commodities, amounting to more than 3,000,000 tons annually, at a very great saving of transportation costs.

The Hoover Commission already referred to and the Department of Commerce estimate that from 21,000,000 to 25,000,000 tons of commodities are at present available for shipment over the St. Lawrence route annually, 80 per cent of which represents exports and imports. This will be very largely increased by the time the St. Lawrence route can be completed. At an average saving of only \$2.50 per ton in transportation costs, this will amount to more than \$50,000,000 annually. This represents a 4 per cent return on \$1,250,000,000.

But it is not only lower costs of transportation through admitting ocean-going vessels to the Lakes that will be of economic benefit to the country. In connection with the improvement of the St. Lawrence for navigation, vast water powers will be developed, ultimately amounting to 5,000,000 horsepower. About 2,250,000 of this amount will be developed along the international section of the river between New York State and the Province of Ontario, one-half of which will belong to the United States. The plan calls for the immediate installation of 1,160,000 horsepower with provision of doubling this amount when a market for the power is available at an additional cost of only \$32,000,000. When the full power on the international section is developed the cost for development and installation will be only about \$100 per horsepower, which will permit its sale to New England and New York users at a much lower price than

power can be produced for in any other way.

The construction of the St. Lawrence route with its incidental development of water power will save many New England industries from ruin.

Another great economic benefit to the entire country will be in the development of the nation's merchant marine. The people dwelling along our coasts have a keen realization of the value of a merchant marine flying the American flag, but the people of the interior, living far from our coasts, do not realize its importance and have been so indifferent upon the subject that legislation necessary to secure a permanent American Merchant Marine has never been enacted.

The St. Lawrence Waterway will add 4,000 miles to the coast line of the nation, an increase of nearly 50 per cent. When ocean vessels ply upon the Great Lakes there will be a visible demonstration of the desirability of maintaining the American flag upon the seas, and sentiment for an American Merchant Marine will then be as strong in the Middle West as it is now upon our coasts. In the great harbors of Chicago, Milwaukee, Superior, and Duluth, ships flying foreign flags will lead to a demand from that section that ships flying the American flag shall outnumber all others.

I have said nothing thus far about the cost of this improvement. The Hoover Committee estimates the navigation cost, that is the cost to the United States and Canada, at from \$123,000,000 to \$148,000,000 to be divided between the two countries. All additional costs would be chargeable to power which will take care of itself and cost the two governments nothing. It estimates the cost of the Lake Ontario-Hudson route at \$506,000,000 and the so-called All-American route at \$631,000,000 all chargeable to

navigation to be paid by the United States alone, for no water power will be developed on either of them.

There is no comparison possible between these routes and the St. Lawrence route from an economic standpoint.

I have reserved for my last point the consideration of the objection that the St. Lawrence Waterway traverses foreign territory, and that from the standpoint of our national defense the St. Lawrence Waterway should not be favored. It is said that, should we be engaged in war with Great Britain, this waterway would admit her dreadnoughts into the Great Lakes, and that our great cities upon those Lakes could be easily destroyed by them. Fortunately, this matter has already been investigated by the United States Government. I quote from a report made by the Board of Engineers of the War Department in 1918:

Such passage could be quickly and completely obstructed by the destruction of the locks in these canals by shell fire, notably in Canadian St. Lawrence River canals where all locks are within seven thousand feet of the United States main river shore; and some not over one half mile therefrom.

So if there was the slightest foundation for the theory that this ocean waterway might admit the English Navy into our Great Lakes and thus become a menace to us if we ever had trouble with Great Britain, our own War Department shows conclusively that every one of these locks and canals could be

destroyed by shell fire from the American side without the slightest difficulty.

But there is another aspect of this question which should be considered, and that is that our determination of this matter should not be affected by any theory that the United States and Great Britain may hereafter become involved in war between themselves. If we are to assume that such is a probability, we should also recognize that should it ever occur such a war would end our civilization, and the world would be destroyed so far as we or our descendants would have any interest in it whatever.

On the contrary, the construction of this waterway as a joint undertaking by the United States and Canada will more strongly cement the friendship between us and our great neighbor to the North. We now have treaty rights giving us equality upon Canadian waters and Canadian equality upon American waters. Instead of being a menace to our National Defense it will furnish the greatest object lesson of friendly coöperation between two great nations that the world has ever known.

It is not within the purview of this paper to discuss the details of the plan of the improvement, its present status, and the steps necessary to bring it to a successful completion.

I have sought to show that it is a great national undertaking of tremendous economic benefit not only to the interior of the nation but to the entire country, and it should receive the support of every patriotic American.



# The Salient Geographic Factors of the Colorado River and Basin

By HENRY F. JAMES  
University of Pennsylvania

THE devastating flood which during the past summer laid waste the lower Mississippi valley was a solemn and sinister reminder that the imperative need of flood control has not been met. It calls sharply to mind, too, the great urgency of the whole problem of effective distribution and utilization of waters. A review, therefore, of the factors relating to this problem in the Colorado River Basin is not untimely.

Since the flood menace in the Lower Colorado Basin has been temporarily mastered, time is available for such a careful study of all phases of the problem as will result in a thorough understanding of the situation, *i.e.*, the utilization of water for irrigation, for domestic supply and for water power, together with such closely allied matters as state and federal jurisdiction, interstate control and distribution and international rights. These are problems of the first magnitude—the work of engineers and statesmen. The phase of the problem here presented is merely a description of the salient geographic factors of the Colorado River and its basin.

## THE COLORADO BASIN

The Colorado Basin in actual territory is greater in extent than any one of the nations of Germany, France or Japan. Lying within the confines of seven states, it covers one-thirteenth of the area of the United States and a considerable section in northwestern Mexico. (See map, p. 88.)

Extreme variations prevail within the basin, from heavily timbered

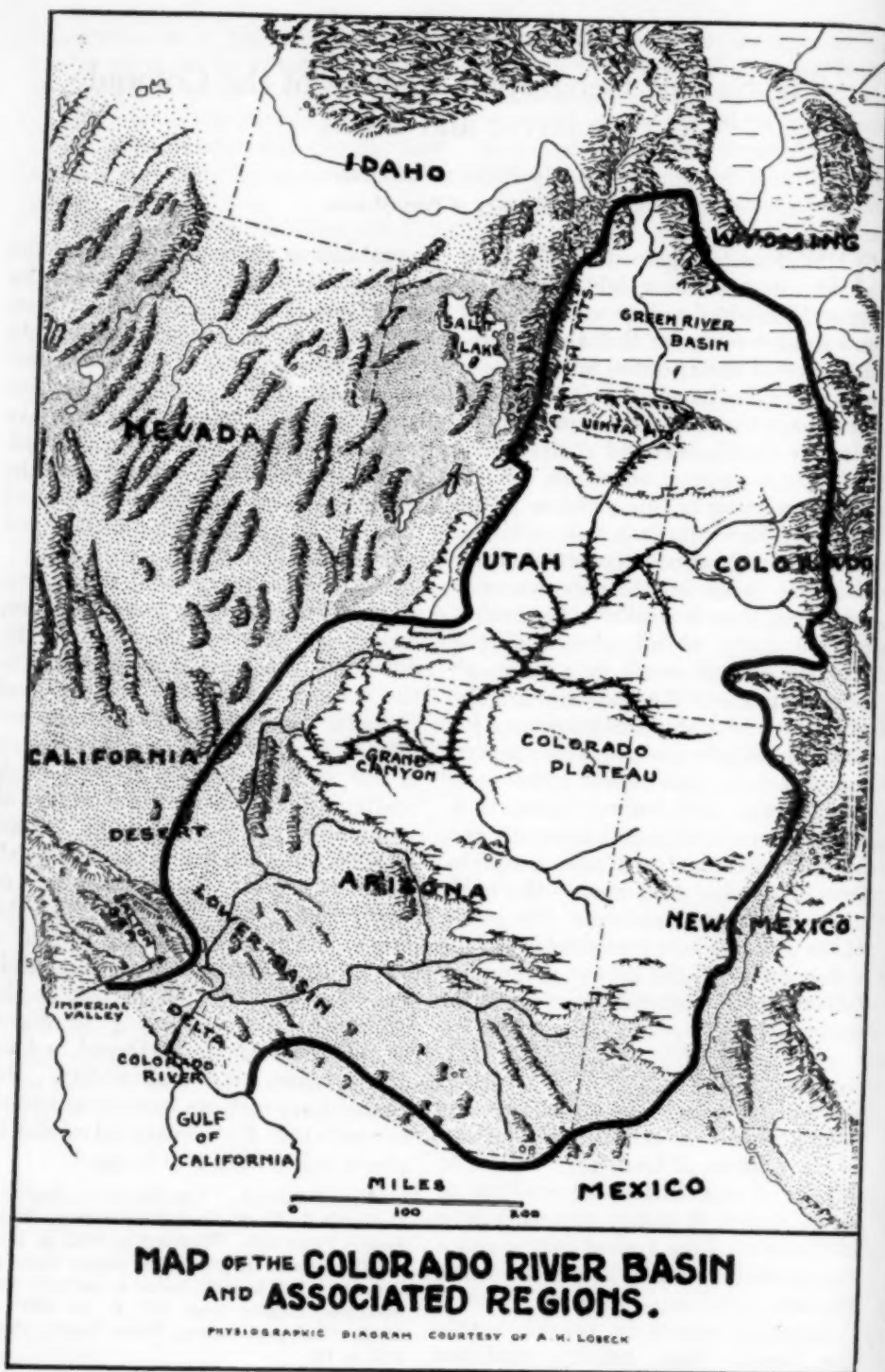
mountains on the high portions of the continental divide to desert areas, the most forbidding in the country; from places famed as summer resorts to those where the heat at times is almost unbearable; from crystalline mountains of solid granite to plains of silt, ash-like in their appearance and from the widest, the deepest, the longest and the grandest chasm on earth—the Grand Canyon—to a meandering shallow bed of soft fine alluvium.

This basin may be divided geographically into two, possibly three, regions. Two portions are decidedly distinct. The lower third is located in the states of Arizona, California and Nevada, and extends a short distance into Mexico. In general, its elevation is but little above sea level, though scattered here and there are ranges of mountains that rise to heights of 2000 to 6000 feet and depressions that fall below sea level. Its northern line of demarcation is a line of cliffs, the Grand Wash Cliffs. These present a bold, often vertical, step that leads hundreds or thousands of feet to the table land above. This is the region of the great American Desert, a land of excessive heat and aridity. Recorded temperatures have been known to reach 130° F.;<sup>1</sup> the annual rainfall in places is less than two inches.<sup>2</sup>

<sup>1</sup> Brown, John S., "The Salton Sea Region—California." U. S. Geological Survey, Water Supply Paper 497. Washington, 1923, p. 13.

<sup>2</sup> The annual precipitation ranges from an inch and a half to eight inches a year with temperatures ranging from 32° F. to 120° F. U. S. Geological Survey, Water Supply Paper 556, p. 12.





The prosperity of this southern section rests upon agriculture under irrigation, but its well-being is recurrently threatened by inundation during flood and its progress is retarded by a shortage of water during dry periods. In 1924 a loss totalling millions of dollars was sustained by the farmers in the Imperial Valley because of lack of water.

In many ways this lower section is similar to the Great Valley of California. Both receive the drainage of the large rivers of the interior. In the Gulf of California the Colorado River has built up its delta and in the California Valley the San Joaquin and Sacramento Rivers have formed theirs. The two areas are nearly at sea level. In each valley the displacement of the sea by alluvium has occurred within comparatively recent geological times. If the land should sink slightly less than 1000 feet, the California Valley would be flooded with sea water through the Golden Gate, while the tides of the Gulf of California would be carried far north of Yuma and the land would be flooded for 200 miles northwest of the present head of the Gulf. Both sections depend upon the melting snows of the higher areas for their well-being. Separating these two valleys are the high ranges of the Western Cordillera with their greatest break at the pass of San Geronimo. Through this gateway pass the trains of the Southern Pacific Railway at an altitude of 2580 feet, thus binding the interior to the Pacific.

The northern two-thirds of the Colorado Basin is a land of mountains and plateaus with an upper basin in Colorado, Utah and Wyoming (Green River Basin, see map, p. 88) and a plateau section (Colorado Plateau, see map, p. 88) in Utah, Nevada, California and Arizona. In the upper basin the northern watershed is ex-

tremely rugged and fairly heavily timbered. Its streams flow through a succession of long, deep, narrow canyons transversed by short valleys that contain small tracts of arable meadow land. Severe winters prevail, but the growing season, although cool, is pleasant with enough warm weather for rapidly maturing crops. Broken plains and scarred plateaus of sedimentary origin are, however, the prevalent topographic features. The annual rainfall of only nine inches on the plains and meadow lands necessitates irrigation which is made possible by natural mountain lake storage and artificial reservoirs. Undeveloped reservoir sites, such as the Kremmling site, the greatest in Colorado, renders possible a more complete utilization of this region.

The plateau part extends from Lee's Ferry to Grand Wash Cliffs. In general, the elevation varies from 4000 to 8000 feet. Great ranges of snow-clad mountains with peaks ranging from 8000 to 14,000 feet are a conspicuous part of the landscape. All winter long on this mountain-crested rim, snow fills the gorges, half burying the forests and mantling the mountain tops. With the approach of the summer sun the life-giving waters are released to go tumbling down the mountain side in millions of cascades. In the words of Major John W. Powell,<sup>3</sup> "these ten million cascade brooks unite to form ten thousand torrent creeks; ten thousand creeks unite to form a hundred rivers beset with cataracts; a hundred roaring rivers unite to form the Colorado which rolls, a mad turbulent stream, into the Gulf of California." For more than a thousand miles along its course through the plateau section, the Colorado has

<sup>3</sup> Powell, Major J. W. "First Through the Grand Canyon—Being the Record of the Pioneer Exploration of the Colorado River in 1869-1870."

cut for itself a canyon not continuous but broken here and there by narrow transverse valleys. The idea of the inaccessibility of the country can best be conveyed by the words of the same Major Powell. "Every tributary river in the plateau has cut another canyon; every creek has cut a canyon; every brook runs in a canyon; every rill born of a shower, and born again of a shower, and living only during these showers has cut for itself a canyon; so that the whole upper portion of the basin of the Colorado is traversed by a labyrinth of these deep gorges." It is a land of strange and weird physical features built on a gigantic scale. Hardly less noticeable than the canyons are the long lines of cliffs, great geographic steps that stretch for hundreds of miles across the landscape and rise frequently thousands of feet into the air. These cliffs are great blocks tilted in such a way that after one has climbed the steep, almost vertical face, he may descend by easy grades to the foot of a second escarpment. Great gateways have been cut through the cliffs by the intermittent streams making possible a journey from the plain below to the terrace above, from arid plains below to forests of pine and fir above with noticeable flora gradations in between. The surface of the plateau is also broken by low mesas that are dry and treeless with frequent gaunt surfaces of naked rock exposed. The region is further diversified by vast systems of fissures, huge deep cracks that are miles and miles in length. In times past from these crevices have poured floods of lava, great sheets of black basalt, that have covered mesas and table lands alike. Here and there along the fissures are found conspicuous landmarks, huge barren cinder cones that are probably the last dying evidence of great subterranean forces.

The unnavigable rivers, buried deep in canyons like the great desert wastes, have prevented easy access to the region so that much of the plateau is relatively unknown. Even today in the canyon region from the mouth of the Green River to the Grand Wash, a distance of 500 miles, there are only three points at which it is possible to reach the river with a wheeled vehicle. In this remote region the Indian still retains his ancient culture. Thirty thousand<sup>4</sup> Hopi and Navajo Indians live on 20,000 miles of Indian reservation. Their life is hard. They still live in the fortress homes built by their ancestors on the easily defended tops of the mesas or follow their flocks and herds from water hole to water hole. The remaining part of the region is given over to a few ranchers and miners with irrigationists located along the more open stretches, but in many places not a living thing is seen, nothing but dry rock in the mountains and dry dust in the valleys.

#### THE COLORADO RIVER

The main artery of this basin, the Colorado River, is approximately 2000 miles long. It extends from Wyoming to Mexico. The characteristics of the river are the key to its many problems. The Colorado may be regarded as one of the most remarkable rivers in the world. It is the greatest undeveloped resource of the states through which it flows, for "it combines in proper sequence for complete use a large quantity of water, a great concentration of fall, reservoir sites for the control of flow, sites for power plants and several million acres of irrigable land below the stretch where power may be developed."<sup>5</sup>

It has frequently been called the

<sup>4</sup> Smith, J. Russell, "North America," p. 472.

<sup>5</sup> Grover, Nathan C., Water Supply Paper No. 556, p. 3, U. S. Geological Survey.

Nile of America and, like the Nile, is subject to potential flood conditions during each summer. The Nile appears to be the greater stream.<sup>6</sup> Its drainage area is 5.7 times larger, with a 3.8 greater annual precipitation. The run-off per square mile of the Nile is 1.9 times greater, but the ratio of run-off to rainfall is two times smaller. The Nile also has a 10.8 times greater discharge than the Colorado. The maximum flow of the Nile, which occurs chiefly about September 1, amounts to approximately 353,000 second feet.<sup>7</sup> This is larger than that of the Colorado by over 200,000 second feet. The maximum flow of the Colorado occurs in May, June and July, a time most propitious for the irrigator. The minimum flow of the Colorado is only from 2500 to 3000 second feet as compared with 14,500 second feet, the minimum flow of the Nile. Thus the necessity for water storage such as is accomplished by the great dam at Assuan, Egypt, is shown to be more urgent still in the Colorado Basin. This fact is also clearly indicated in a study of the main flow of the two rivers. For the period 1894-1910, the main flow of the Colorado was not above 26,000 second feet, while that of the Nile amounted to 115,800 second feet.

The profile of the Colorado River is likewise one of its dominant characteristics. In 1800 miles, the river drops from an elevation of 13,579 feet<sup>8</sup> to sea level. The Nile has only a drop of 7000 feet<sup>9</sup> in a distance of 3473 miles.

<sup>6</sup> All statistics relative to this comparison taken from the U. S. Geological Survey, Water Supply Paper No. 289, pp. 26-27.

<sup>7</sup> Second foot is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream, one foot wide, one foot deep, at a rate of one foot per second.

<sup>8</sup> Clark, W. G., "The Colorado River," p. 7.

<sup>9</sup> Encyclopedia Britannica, 11th edition, Vol. 19, p. 692.

If comparisons are made with many other power-yielding streams of the United States, the potential power possibilities of the Colorado appear to be enormous. The Mississippi River from Cape Girardeau to the Gulf of Mexico has a drop of only eight inches<sup>10</sup> per mile. The power possibilities of the Tennessee are considered important, but that river has a drop of less than 500 feet between Knoxville and Paducah, a distance of approximately 700 miles.<sup>11</sup> The canyon section has great possibilities in the concentration of water power sites. Between Green River, Utah, and Parker, Arizona, there are at least twelve favorable dam sites where a continuous development of over 4,000,000<sup>12</sup> horsepower can be made. In this respect its only superiors are the St. Lawrence and Columbia River Basins.

The Colorado River and its tributaries are hard-working streams. They bring to the delta, 105,000<sup>13</sup> acre feet of silt per year. This amount would cover 105 acres to a depth of 1000 feet. In terms of yards, this equals 170,000,000, or an amount equal to two-thirds of the total material excavated in the construction of the Panama Canal. Six million average railroad cars would be needed to transport this material. Driftwood is also carried during flood periods. In the flood of September, 1923, hundreds of logs 20 to 30 feet long and 2 to 3 feet in diameter passed through the Grand Canyon.

With this description of the geographical conditions of the Colorado River and its Basin as a background, we may now turn to a brief analysis of some of its important problems.

<sup>10</sup> *Ibid.*, Vol. 18, p. 604.

<sup>11</sup> Brown, R. M., "Utilization of the Colorado River," *Geographical Review*, July, 1927, p. 456.

<sup>12</sup> U. S. Geological Survey, Water Supply Paper 556.

<sup>13</sup> *Ibid.*, p. 16. See table.



### THE FLOOD MENACE OF THE COLORADO<sup>14</sup>

The river emerges from the hills and canyons as a law-abiding stream for ten months of the year. For the remaining two months in the early spring, it is almost uncontrollable. Instead of a blessing it then becomes a threat to man and all his works in the Lower Basin. The value of the property that is menaced by these floods exceeds \$100,000,000, while at least 50,000 people are living in the shadow of just such a great catastrophe as occurred in 1905 and was repeated over a very limited area in 1909. In 1921 a recurrence of these disasters was prevented only by a shift of the wind that drove the waters back. Man's existence here is precarious in the extreme for on the holding of a long thin line of granite-faced levees depends his safety.

The geographical nature of the country itself makes floods possible. Some thousands of years ago this endangered land was part of the Gulf of California, a great arm of the ocean that extended

150 miles inland from its present limits. In fact, its waters probably washed the slopes of the San Jacinto and San Bernardino Mountains and covered a land that is now arid mountains and desert plains. The Colorado River emptied its waters into an eastern arm of this body of water that reached nearly to the present site of Yuma. Into it has been deposited through aeons of time the mud and rock scoured from high mountains and worn out of deep canyons. Inch by inch the water was driven back until this eastern basin was entirely filled. Onward spread the delta until it reached the eastern base of the Cocopa Mountains. Thus was formed a dam that separated the Gulf into two parts, one entirely cut off from the ocean. The dam increased in height and breadth from decade to decade until today the dam above sea level is nearly 100 miles wide. On top of this delta bridge flows the Colorado River at a height of approximately 30 feet above the sea and actually higher than the adjacent country. To the northwest lies the old Gulf bed, now a region of interior drainage with but a remnant, the present Salton Sea, left of that historic ocean arm. The lowest part of this basin is 300 feet below the level of the river and only 70 miles away. To the south lies the recent delta land with the Gulf of California 50 miles in the distance. The waters of the Colorado pass down the gentle slope towards the Gulf.

The direction of the river is unusual for a grade nearly ten times as steep leads into the Salton Basin and Imperial Valley. Forty-three thousand people, at least the population of the Imperial Valley of California, desire a continuation of this condition. They wish for no replica of the biblical flood. A modern system of levees has been constructed at which the river in recent years has really pounded in

<sup>14</sup> References consulted in the study of floods are:

- (1) An article by James H. Gordon, *Monthly Weather Review*, February, 1924. "Problems of the Lower Colorado River," pp. 95-97.
- (2) An excellent scientific discussion of river control in the Colorado River Delta by H. T. Cory, in Paper No. 1270. "Transactions of the American Society of Civil Engineers," Vol. 76, 1913.
- (3) Mendenhall, Walter C., U. S. Geological Survey, Water Supply Paper No. 225.
- (4) Entenman, P. M., "Flood Danger in the Colorado Delta," *Engineering News Record*, March 31, 1927.
- (5) Priest, R. M., "Channel and Levee Conditions in the Colorado Delta," *Engineering News Record*, March 17, 1927.
- (6) Sykes, Godfrey, "The Delta and Estuary of the Colorado River," *Geographical Review*, April, 1926, Vol. 16, No. 2.



vain. It is a risky situation at best, for not always has the river flowed in its present channel. Time and time again in the ages past the geologists tell us that the river has turned its waters into the interior basin and at a later date turned again towards the Gulf. Up until 1905, for many hundreds of years, it has flowed untroubled to the Gulf. The great interior basin became practically empty of water through evaporation and seepage for the run-off from the mountains that surround the sink is too slight to maintain a permanent water body in this region. From a great arm of the ocean it had become a desert waste, sun-baked and desolate. Engineers were determined to harness the Colorado, making of its water a blessing to this parched land instead of a curse. They found the river difficult to handle. Canals that made possible the proper distribution of the water quickly silted up. New channels had to be built constantly as a greater and greater demand for water came with increased population. Man thus weakened the natural dams that kept the river in its proper channel and also neglected to provide sufficient protective head works for the canal that had a gradient much greater than that of the river. The result was that, in 1905 and 1906, during the periodical floods, the river broke through and hurled 87 per cent of its volume into the Salton Basin. Only after sixteen months of effort and an expenditure of \$2,000,000 was the river turned back into its old channel. But the battle is not over. The river is bringing down its 6,000,000 carloads of silt and mud each year, a hundred thousand acre feet of damming material. Man in order to hold the balance of power has thrown in 6000 carloads of rock. How long can this unequal warfare be continued? Each year the threat of disaster is renewed

and the situation becomes more and more critical. With the increase of cotton and alfalfa fields, orchards and vineyards, another break would be a calamity. The levees are not positive preventives. Something must be done to regulate the flow of the stream during its violent periods. The building of dams and the ponding of its waters in a few of its great canyons is the only permanent preventive of a possible catastrophe.

#### THE PROBLEMS OF IRRIGATION

The streams of the Colorado Basin are already utilized for irrigation to a considerable extent. From a probable beginning on the upper Greer River in Wyoming, the irrigated lands had increased in acreage until, in 1922,<sup>15</sup> the total area irrigated amounted to 2,398,000 acres. Of this amount approximately 1,500,000 acres<sup>16</sup> were irrigated in the Upper Basin. This was an increase of approximately 1,000,000 acres since 1899.

Irrigation is necessary here because of the climate. Nowhere do the areas that are possible to irrigate have a rainfall of over eight inches. Summer temperatures of 100° F. are not uncommon even in the plateau section of the basin. In the Lower Basin the chief climatic characteristics are the excessive summer heat and dryness. During the five hot months, the temperature will average over 90° in the lowlands. The climate is trying for man and beast. The air is not stagnant. Gales with their accompanying sandstorms that last for a few hours are not uncommon. The heat and the wind together keep the surface very dry and cause excessive evaporation from exposed water bodies. Rain in

<sup>15</sup> See table on page 94.

<sup>16</sup> LaRue and Holbrook, U. S. Geological Survey, Water Supply Paper No. 556, Appendix A, Water Supply, p. 109.

TABLE I.—IRRIGATED AND IRRIGABLE AREAS IN THE COLORADO BASIN IN 1922.

(Extracted from an article by R. M. Brown, *Geographical Review*, July, 1927)

	Areas in Acres		
	Irrigated 1922	Additional Irrigable	Total
Upper Colorado Basin.....	1,477,000	2,740,000	4,187,000
Lower Colorado Basin.....	521,000	1,467,000	1,988,000
Gila Basin.....	430,000	400,000	830,000
Totals.....	2,398,000	4,607,000	7,005,000
Wyoming.....	235,000	522,000	757,000
Colorado.....	800,000	1,460,000	2,260,000
Utah.....	386,000	377,000	763,000
Nevada.....	7,000	7,000	14,000
New Mexico.....	50,000	408,000	458,000
Arizona.....	493,000	1,312,700	1,806,000
California.....	426,700	520,300	949,000

the form of cloudbursts occurs at times. The flood waves so caused are responsible for practically all of the desert erosion, but the total rainfall annually is not over eight inches.<sup>17</sup>

Irrigation is possible here because of the supply of surface and ground water available. From the former source practically all dependence will be placed by future reclamation projects. The amount of surface water used at present amounts to 6,700,000 acre feet (1924), of which slightly over 3,000,000 acre feet were used in the American section of the Lower Basin and 780,000 acre feet in Mexico. The United States Reclamation Service believes that eventually the Upper Basin will require annually for direct use 6,550,000<sup>18</sup> acre feet of water and the Lower Basin 8,282,000 acre feet. There will also be some loss through

<sup>17</sup> U. S. Geological Survey, "Some Desert Watering Places," Water Supply Paper No. 224, pp. 12-13.

<sup>18</sup> Includes the amount that will eventually be diverted in the vicinity of Denver to the Mississippi watershed, and in Utah to the Great Salt Lake Basin—in the neighborhood of 440,000 acre feet.

evaporation and seepage from river, canal and reservoir. The mean annual flow of the Colorado at Yuma, Arizona, from 1894-1911 was 12,388,000 acre feet.<sup>19</sup> In 1894, however, it amounted to only 5,390,000 acre feet, while in 1909 the discharge equaled 26,000,000 acre feet. It can thus be clearly seen that the maximum development of irrigation in the Colorado Basin cannot be obtained without the development of a comprehensive plan for storage and regulation of the waters of the Colorado River. The Lower Basin at present is beginning to feel a shortage of water during exceedingly dry periods.

The problem of storage and regulation is difficult because of the number of states and nations involved. The border states have not yet reached an agreement in regard to the distribution of water between them, although the Federal Government, in 1922, through the person of Herbert Hoover, brought the state delegates together in Santa Fe, New Mexico. The result

<sup>19</sup> Cory, H. T., *op. cit.*, pp. 1210.

was the Colorado River Compact,<sup>20</sup> which was agreed to at that time by all the participating states with the exception of Arizona. Since then Utah has rescinded her action while the adherence of California is conditional on the building of the Boulder Canyon Dam by the Federal Government. An international agreement is also necessary because Mexico has approximately a million acres of land irrigated or available for irrigation in the Colorado Basin. To further complicate the matter the Mexican projects have been developed largely through American capital and water for the Imperial Valley (California) is brought through the Mexican-American Canal, which is largely located in Mexican territory.

Two engineering problems in connection with irrigation are serious. One is the danger of diverting water from a wide, erratic stream that flows through a shifting channel as does the Colorado on the top of the delta ridge dam. The other is the difficulty of keeping open canals in a region where the water is so heavily charged with silt. During flood stages the water carries all the silt that it is able to transport. The size of the silt particles depends upon the speed of the stream. Records kept of conditions in the Imperial Valley irrigation area indicate that the beds of many of the canals were raised between two and five feet in a period of three years. This reduction in capacity which is slightly noticeable in the larger canals and especially critical in the smaller laterals makes a larger number of canals necessary or constant dredging in order to keep the channels open. The cost of

keeping the canals open varies from \$50 to \$60 per mile.<sup>21</sup> The Imperial Water Company No. 1 maintains in the neighborhood of 400 miles of canals.

It has also been noticed that the soil in places is heavily impregnated with alkali. Alkali is the accumulation in the surface layers of excessive amounts of soluble salts, mainly chloride and sulphate of sodium. All desert soils, especially those of the silt variety, that are fine enough in texture to permit capillary rise of water through them, are likely to become alkali. The Bureau of Soils of the U. S. Department of Agriculture has presented a very unfavorable report<sup>22</sup> regarding the alkali conditions of the soils of the Imperial Valley. It advised the planting of crops, such as sugar beets, sorghum and date palms that are suited to alkaline soils and to abandon as worthless the land which contained too much alkali to grow these crops. The warning was repeated in a later report. The repeated application of water to these lands will have a tendency to increase the alkalinity. This condition will then develop a problem of drainage that has not yet seriously added to the farmers' burden.

Still another fact in regard to irrigation must be realized. What has been the result of irrigation projects already established by the Reclamation Service? Is there a noticeable need at the present time for further development? Bowman<sup>23</sup> states that "the total farming population upon the twenty-four national irrigation projects of the West after twenty-five years of government aid and generosity is but 137,000, a population equal to that of the city of

<sup>21</sup> Cory, H. T., *op. cit.*, pp. 1294-1295.

<sup>22</sup> Field Operation of the Bureau of Soils, U. S. Department of Agriculture, 1901. A later report appeared in 1903.

<sup>23</sup> Bowman, Isaiah, "The Pioneer Fringe," *Foreign Affairs*, Vol. 6, No. 1, October, 1927, p. 61.

<sup>20</sup> For the complete text of the compact see 67th Congress, 4th Session, House of Representatives, Document No. 605. An excellent discussion is also given in the "Colorado River, History, Seven States Compact and Future Development," by Walter Gordon Clark.

Hartford, Conn., or Grand Rapids, Mich." He further emphasizes the fact that "the most trifling improvement of agricultural practice in settled communities will accomplish much more in the production of agricultural products and the growth of population than all the millions that have been poured out upon the irrigation projects of the West in a quarter of a century." Further irrigation development at present appears of doubtful necessity.

#### POWER DEVELOPMENT

Power development as the keystone of the arch of Colorado River conditions is the hope of those interested. By the sale of power they expect to pay largely the high cost of flood control and irrigation water storage. From a production point of view, their hopes are justified. Nature has been so kind that the average discharge of the river (see page 7) together with its steep gradient and numerous power sites is sufficient to develop from five to six million horsepower of hydro-electric energy. The U. S. Geological Survey has recommended thirteen power sites<sup>24</sup> that would produce 5,743,000 horsepower with maximum use of the water in the Upper Basin.

Three problems vital to the full realization of this ambitious program must be considered. In the first place, storage for flood control and for power development is in striking conflict.<sup>25</sup> "Flood control reservoirs need to be kept empty and ready for flood service, while power development reservoirs need to be kept full to ensure steady power." The noted engineer, Arthur E. Morgan, believes that it is a grave mistake to try to combine them. The question of cost is also

paramount. The cost of the Boulder Canyon Project alone, including the erection of a power plant, is estimated in the neighborhood of \$75,000,000. If the cost is to be met by the sale of electricity, the question of distance must be considered. It is 250 miles from Boulder Canyon to Los Angeles, the principal market for power. San Diego is approximately 300 miles away; Yuma, Arizona, 250 miles. The principal mining districts in Arizona and Nevada are at a distance greater than 250 miles. Engineers estimate that the Boulder Canyon power would cost \$50 per horsepower delivered in Los Angeles where power is now generated by steam at a cost of \$40 per horsepower. It appears highly problematical whether power generated in a desert hundreds of miles from available market can be put on a paying basis for many years to come if at all within the lifetime of the men backing the proposition.

Problems of power, flood control, water diversion for irrigation and urban purposes and the disposal of silt cannot be solved singly. Together they make up the problem of the most economic utilization of the waters of the Colorado. The flood menace must be conquered within a few years or disaster will result, but consideration of the other factors of the equation is essential, or else in providing for the immediate present mistakes will be made that will prevent the fullest utilization of this great river and postpone indefinitely the complete development of the adjacent states. At present, there are many disputed points. Dam sites cannot be agreed upon. State rights vs. federal control is a burning question. Private corporations are fighting the national government for control. The interested states are unable to agree. These differences will no doubt be ironed out eventually. It is

<sup>24</sup> See table, p. 46, Water Supply Paper No. 556, U. S. Geological Survey.

<sup>25</sup> Morgan, Arthur E., "The Mississippi," *Atlantic Monthly*, November, 1927.



a gigantic task, however, that must be studied carefully and scientifically in order that the Colorado River, now a menace, will be eventually harnessed for man's benefit and man's enjoyment.

## Legal Problems in Colorado River Development

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**I**N the present article it is my purpose to discuss but a very limited number of the legal questions in Colorado River development. Numerous briefs have been written by firms of competent lawyers whose professional duty it is to give advice on such questions as whether or not Arizona is correct in asserting her right to tax each unit of power developed within her borders, whether or not Denver may divert water from the Colorado watershed, whether or not there is any possibility of Los Angeles being able to secure title to water which it is anticipated will be stored in Boulder Dam, and a score of other important issues of similar or different nature. Accordingly, in the selection of the subjects treated I have been guided by the belief that a person occupying the position of a disinterested observer and student will be performing the best service by calling attention to the broad outlines of a plan for the improvement of this interstate stream. To such a plan I have devoted major consideration, with the result that many obvious legal questions are omitted from the present paper. But although these be omitted it is with the hope that the plan suggested may prove worthy of consideration and thereby compensate for the neglect of other material.

The topics which are to be discussed in the succeeding paragraphs may be listed as follows: the present importance of the Compact drafted at Santa Fe in 1922, the legal background of the

Compact, the proper sphere of activity of an interstate Colorado River commission, and a suggestion that conservancy districts be organized in the interested states for the purpose of contracting with each other relative to Colorado River matters.

### PRESENT IMPORTANCE OF THE COMPACT

Without doubt the Colorado River Compact drafted at Santa Fe, New Mexico, in 1922, will continue to be the starting point of all discussion for any plan finally agreed upon to further Colorado River development. Fundamental groundwork was laid by the drawing of that agreement. Nor has the stormy course experienced by the Compact during the past five years served to make the preliminary work of less value. Certain underlying issues are now more widely apparent than was true of the situation several years ago, in spite of the fact that the seven-state treaty is not effective. Arizona's consistent refusal to ratify, California's ratification conditioned upon storage, and Utah's recent step in rescinding her earlier ratification, together with Colorado's insistence that not a shovel of earth be turned for the development of any project in the Colorado below Lee's Ferry before the Compact shall have been accepted by at least six of the seven states—a point of view at one time written into the Swing-Johnson bill but now replaced by the idea that construction may proceed upon acquiescence of the Compact's terms by only three of the interested states—have all combined to make the Compact the most important single

<sup>1</sup> Author of "The Colorado River Compact," pp. xxiv, 527, published by Southwest Research, Los Angeles.

document in the entire Colorado River controversy.

#### LEGAL BACKGROUND OF THE COMPACT

From a study of the minutes of the twenty-seven meetings of the Colorado River Commission at which the different paragraphs of the Compact were drafted, and from a careful investigation of other source material, I am convinced that the sponsors of the proposed seven-state agreement thought that such a treaty was necessary as a means of circumventing the prior appropriation system of determining water rights on the Colorado. The *Wyoming v. Colorado Case*, 259 U. S. 419, decided by the Supreme Court of the United States on June 5, 1922, held that, as between two prior appropriation states, water rights on an interstate stream would be determined upon the basis of prior use irrespective of state lines. This had been for many years a contested point in water rights litigation involving interstate streams, but the possibility of a decision such as the Supreme Court gave in the *Wyoming-Colorado case*, had been foreseen by those familiar with the question. Coming as it did during the hearings of the Colorado River Commission in different cities of the Southwest preliminary to the Santa Fe meetings, the decision in *Wyoming v. Colorado* confirmed the fears of representatives of Colorado and other upper basin states that the stage was being set for the permanent appropriation of Colorado River waters by water users of the lower basin states to the everlasting detriment of the upper basin.

The chief factor which contributed to this belief was the more rapid movement of population from the Eastern centers to areas in the lower basin, particularly southern California, than to the areas of the upper basin. Along with the population came an almost

insatiable desire for water for domestic and agricultural purposes because of the general aridity of the lower basin areas. More than this, a large population meant a corresponding political and financial power to build the works required in the process of placing the waters of available streams to beneficial use.

Little wonder, then, that legal representatives of the upper basin states upon surveying, on the one hand, the rules of law applicable to problems of this kind and, on the other, the trend of events pointing directly to the appropriation of large quantities of water for beneficial purposes in the lower basin at an earlier date than the water would be needed in the upper basin, were spurred by the *Wyoming v. Colorado* decision to renewed efforts in their attempt to modify the prior appropriation doctrine of water rights with respect to the waters of the Colorado. States of the lower basin had nothing to gain by changing the prior appropriation doctrine so long as development continued under the appropriation system; states of the upper basin had everything to gain by changing that system, for if the prior appropriation doctrine continued to apply, the states of the upper basin might find that, due to its prior application to beneficial use by the lower basin, no unappropriated water would remain for use in the upper basin at the time that the upper basin becomes ready to use it.

While it is true that states of the lower basin had nothing to gain by changing the prior appropriation doctrine so long as development continued under that system, it should be noted that such development, as a matter of fact and until a change of policy by the Federal Power Commission, is at an end unless some uniform plan is made for the Colorado's development. For several years the Federal Power Com-

mission has been reluctant to grant permits for Colorado River construction because of the obvious benefits to be realized from the use of a coördinated plan of which each individual project should be a part. But to projects in which large sums have been expended in preparatory work, such as the Girard project, the Federal Power Commission is said to stand ready to give preferred consideration upon the withdrawal of the general order of suspension of permits. This general order may be withdrawn at any time that the Commission deems reasonable. That is, if the members of the Commission believe that it is unlikely that a unified plan can be agreed upon by the seven states, they will perhaps allow construction of the better projects to proceed without reference to a general plan. This will, of course, make possible the appropriation of water and the vesting of rights.

#### THE PROPER SPHERE OF ACTIVITY OF AN INTERSTATE COMMISSION

One of the legal questions of prime importance in Colorado River development is the question of whether or not the seven states may enter into a compact and thereby achieve the legal result of dividing the water of the Colorado in the manner attempted by the terms of the Santa Fe agreement. That Compact, it will be recalled, attempted to apportion a definite amount of water to the upper and lower basins respectively.

But can the apportionment of the waters of an interstate stream, even though ratified by the legislatures of the states concerned and by Congress and in the event that it is finally determined by the courts to be legally sound, be of any practical benefit if there is not a sufficient amount of water in the river to satisfy present users and those who wish to become appropriators,

some of whom now have their applications on file with the state commissions or with the Federal Power Commission or both? Is it within the legal power of a group of states to enter into an agreement with one another, such agreement being sanctioned by the legislative branch of the Federal Government, and by the terms of said agreement superimpose a new system for the determination of rights in the waters of an interstate stream which may conflict with the legal methods already established by the individual states for the determination of water rights? Is it not true that the first step in Colorado River improvement by the coöperative effort of the interested states should be a survey of the water rights now recognized and vested under the laws of the several jurisdictions? Present users must be taken care of regardless of what particular method of improvement is finally selected.

It is also probable that certain applications now on file with the various states would be found to be entitled to priority under the laws of the states having jurisdiction. Such inchoate interests should also be included in the survey. With these data at hand an interstate commission, called a Colorado River Authority in my book, would be in a position to recommend those steps for the development of the stream which would best serve the interests of all parties. Members of such a commission would then definitely know the particular rights affected by any proposed construction project and could attack condemnation and other specific problems with some hope of making progress.

The whole purpose of the present agitation for Colorado River development is, of course, to increase the quantity of water available for beneficial use. This quantity will be determined by the particular plan



adopted for the development of the stream. And this is one point at which the Compact of 1922 has proved entirely inadequate. No mention was made of particular projects. Let it be clearly understood that I do not say that more progress could have been made the past five years if the Compact had referred to definite engineering programs, for perhaps the plan worked out was as much of a forward step as could then be taken. But that it was inadequate, the last five years of inaction and controversy abundantly establish.

The Compact spoke of millions of acre-feet of water without a word about plans for making that water available. It attempted to tamper with the acknowledged system of water rights by asserting that the upper basin should have 75,000,000 acre-feet for use within the upper basin during each ten-year period, and that a like quantity, increased by a million acre-feet per year, should be available for use in the lower basin during each ten-year period.

But to declare that water shall be used in certain quantities in designated places does not make the water available for such use. This was realized by California when the legislature of that state attempted to couple a tangible project—Boulder Dam, contemplated by the Swing-Johnson bill—with assertions of the Compact concerning water rights. The manner in which the California legislature proceeded was to make construction of a storage reservoir in the lower basin a condition precedent to California's acceptance of the provisions of the Compact relative to the fixing of water rights. This action clearly shows that California appreciates the fact that an abstract statement concerning rights to water, which is not as a matter of fact available for use, is of little or no value.

The only interstate agreement which will finally gain sufficient support to result in ratification will be one, I believe, in which provision is made for engineering surveys to determine upon the best plan to make available the largest possible quantity of water and also to serve all other purposes of river development such as flood control and power generation. Coupled with these provisions there may very properly be a declaration of the manner in which rights to the water about to be made available may come into being.

In other words, when an inventory of all the water rights now existing on the Colorado shall have been made by an interstate commission, and when a survey of the most economic engineering plans for the development of the river shall have been completed, we will know how much water will be added to the present available supply. Knowing this, and knowing that the particular project determined upon for the development of the stream is the best and most economic method, the interstate commission could then undertake the next problem of suggesting the method or methods of creating legal rights to the water about to be made available. This portion of the work of the interstate commission might take the form of a suggested uniform water code for the interested states to be applicable only to the quantity of water made available by the completion of the engineering project finally selected.

The procedure outlined in the preceding paragraphs may seem to require too long a period of time before results could be realized. But those who have watched the situation during the past five years must be convinced that actual construction of Boulder Dam, the most widely heralded project on the Colorado, is now more uncertain than has been the case at any previous time

within the past five years. This is due to the fact that instead of making a survey of the whole river for the purpose of determining the best manner of developing it as an asset of the entire region, and therefore of the nation, greatest emphasis has centered around the question of the most feasible method of securing flood control for Imperial Valley and a water supply for southern California. And there are some who go to the extent of saying that plans now proposed for these specific purposes are not at all the most economical which might be devised to realize the desired ends.

Events of the past half decade clearly show that the most essential single thing for an interstate Colorado River commission to do is to provide a forum where the contentions of all parties may be submitted for consideration upon their merits. These contentions may relate to engineering, economic, or legal data. But whatever their nature, they should be available for scientific study and analysis by all interested parties. Had there been such an interstate commission in operation the past five years it is quite probable that the assertions of the Arizona High Line Association and of the sponsors of a gravity line from the mouth of the San Juan across southern Utah, across Nevada and California to the Imperial Valley, either would have been verified or exploded by the present time in a manner carrying conviction. As it is, these questions and a host of others of similar nature, to say nothing of the legal controversies, serve only to confuse the public.

#### CONTRACTING CONSERVANCY DISTRICTS

Assuming that an interstate compact between the seven states will some day provide for an interstate commission whose duties will approximate

those above described, and assuming further that such commission will have completed the inventory of water rights existing prior to construction of any particular project on the Colorado and will have heard all arguments relative to the best engineering plan to be adopted, thus fostering an intelligent public opinion, and assuming further that such a commission also will have aided in working out the legal questions centering around the determination of water rights in the use of the additional quantity of water made available by the proposed new construction, the next step in Colorado River development should be the organization of conservancy districts to contract with each other relative to existing water rights and water rights which will be brought into existence by reason of the appropriation of water not now available but which will become available upon the construction of the engineering works finally believed to be the most desirable. In fostering the organization of these districts in the interested states an interstate commission would have an important part to play.

The general plan of organization of these districts might be similar to that of the conservancy districts of Ohio and New Mexico. These districts, analogous in some respects to irrigation and drainage districts of the various states, permit a large degree of local control of the coöperative enterprise. The primary purpose of the legislative act of Ohio is to provide a means whereby the owners of property in areas threatened by floods may organize for their mutual protection. However, this act<sup>2</sup> also states that its purposes include that of "providing for irrigation where it may be needed." New Mexico's statute,<sup>3</sup> as might be

<sup>2</sup> 104 Ohio Laws 13-64, February 5, 1914.

<sup>3</sup> Laws of New Mexico, 1923, Chapter 140, pp. 211-278, March 12, 1923.

expected, places more emphasis upon the reclamation features of the conservation program, though provision is also made for meeting flood dangers.

In other words, both Ohio and New Mexico have provided a method by which the owners of the land affected by a particular project may determine the manner in which that project shall be controlled and administered. This manner of dealing with the problem conserves the benefits of local self-government. By means of the organization of a number of conservancy districts in the states of the Colorado Basin, the groundwork would be laid for a series of contracts among such districts with respect to definitely determined water rights. But before these districts can be organized, the route of the main aqueducts which will eventually constitute the best unified system of development to serve the largest number of interests or purposes in the entire basin must be determined. Only in this manner will it be possible to know the areas which will be directly affected by the development and therefore included within the proposed conservancy districts.

Looking more closely at the language of the New Mexico Act we find that it provides that the district court sitting in and for any county of the state, or any judge thereof in vacation, is vested with jurisdiction to establish conservancy districts. These districts may be entirely within or partly within and partly without the judicial district in which said court is located. A partial list of the purposes for which the conservancy districts may be formed is as follows: preventing floods; regulating stream channels by changing, widening and deepening the same; regulating the flow of streams; constructing irrigation and drainage works or systems; coöperating and contracting with the federal or any state

government to promote the agricultural resources and marketing facilities of the district.

The manner of organizing the district is by petition filed in the office of the clerk of the court vested with jurisdiction. Such petition is to be signed by one hundred owners of land or by a majority of the owners of land situate within the limits of the territory proposed to be organized into a district. In the event that private or public corporations own lands within the proposed district, such corporations are proper parties to sign the petition. Moreover, any city interested in some degree in the improvement, upon proper action by its governing body, may alone file the petition already mentioned. Following the hearing of any protests against the organization of the district, the court is to declare the district organized and give it a corporate name by which it is thereafter to be known.

The remaining articles of the New Mexico Act refer to the powers and duties of the board of directors of the conservancy district, appraisals of benefits, and financial administration.

Upon the organization of these conservancy districts in the states interested in the development of the Colorado the way would be cleared for a series of contracts between the various districts as parties, by which to determine the details of the use to which available water might be placed and the terms of remuneration for such use. Plans for the necessary construction work might also be handled by contract between the districts concerned.

In accordance with the Act of August 11, 1916,<sup>4</sup> conservancy statutes of the kind suggested would also be applicable to the public lands of the United States lying within the conservancy district, upon the approval of

<sup>4</sup> Chapter 319, 39 Stat. 506.

the Secretary of the Interior and subject to certain exceptions mentioned in the act. Briefly stated, the purpose and effect of this statute is to empower the Secretary of the Interior, following the presentation of a proper application therefor, to investigate the plans and financial and physical resources of irrigation districts theretofore or thereafter organized pursuant to the law of any state, and, if he shall find and conclude that any such district has planned and is executing an altogether meritorious and feasible irrigation undertaking, to grant his approval of its plan and undertaking, provided a majority acreage thereof is not unentered land. Upon such approval and upon compliance by such districts with certain conditions in said act specifically set forth, all unentered public land and land which has been entered, but upon which final certificate has not issued, shall be amenable to the state laws governing the district to the same extent and upon like terms as are privately owned lands within said districts.

#### CONCLUSION

In conclusion it may be said that the Compact drafted at Santa Fe in 1922, which has been the subject of innumerable conferences since that date, will perhaps never be ratified by the seven states in its present form because of its failure to mention a specific engineering project to make additional water available. Its inadequacy in this respect creates a situation in which the upper states cannot allow any construction to proceed in the lower basin before the compact is ratified, and the lower states, particularly California,

cannot afford to ratify until the support of the entire basin for storage facilities in the lower basin is guaranteed to the lower states. But an understanding of the present Compact and the discussions which have centered around it, are of the greatest importance if the fundamental issues which surround the Colorado are finally to be resolved into a unified plan of action.

As one observes the present situation he is led to inquire if the experience of the past five years has not shown that a new approach to the problem would be advisable. Instead of attempting to apportion the waters of the stream before a unified engineering plan has been worked out and accepted by the seven states, the United States and Mexico, why should there not be an interstate commission created by the use of the interstate compact clause of the Federal Constitution for the purpose of examining all proposed plans for the development of the river? By means of the discussion which would accompany such a process there is reason to believe that confidence would be developed so that every representative and senator from the interested states would be ready to vote for the particular project decided upon. To develop this confidence should be the first and fundamental purpose of an interstate commission. It does not seem possible to develop it by discussing rights to water which is not yet available for use. But if everyone believed that a specific engineering plan for the development of the entire river would get the maximum use out of the stream, a continuing interstate commission would have something upon which to proceed.



# Engineering and Economic Features of the Boulder Dam

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**ALTHOUGH** the present agricultural and commercial development of the Colorado River has been accomplished during the past 75 years, practically four centuries have elapsed since the first white man gazed upon its waters. During these centuries, the information left by the diaries of the intrepid Padres and explorers from time to time have given brief mention of the high waters and terrific floods which prevented their crossings or fought them in their endeavors to sail up the Lower River below Yuma.

The Colorado River has a total length of approximately 1750 miles, a drainage area of 244,000 square miles and a total annual water supply of approximately 21,700,000 acre feet. The larger portion of this water is supplied by the melting snow from the summit of the Rocky Mountains in western Colorado and Wyoming, but an appreciable portion is also furnished by the drainage area below the junction of the Green with the Colorado, a section subjected at certain seasons to violent storms of short duration commonly known as cloud-bursts. The effect of these storms and of the fluctuation in the melting snows is indicated by the differences in the river flow, annual discharges as great as 26,000,000 acre feet and as low as 8,000,000 acre feet having been recorded at Yuma.

## *Magnitude of Floods*

While records have indicated the low flow of the river at less than 1300 cubic

feet per second or second feet, in flood season—May and June—the discharge at times is more than 200,000 second feet by actual measurement, and the flood of 1884 was estimated at 384,000 second feet. Marks left by high water at some time previous to known records would indicate a discharge greatly in excess of this figure and reaching possibly 500,000 second feet.

## *Silt*

In addition, due to the flood characteristics and to the effect of heavy storms on a large portion of the area, as well as the soil and topography of the country through which it flows, the river carries a tremendous burden of silt estimated from direct measurements at approximately 113,000 acre feet, or more than 182,000,000 cubic yards per annum.

## *Imperial Valley*

Originally the Gulf of California extended approximately 200 miles north of its present shores and 100 miles north of the present Mexican boundaries into southeastern California. The Colorado River, heavily laden with the silt brought from the upper regions, has, during the centuries, deposited its burden as it entered the Gulf from the east side; gradually forming a huge delta which, working its way across, finally separated entirely the upper portion from the Gulf proper. After the separation and due to the silt formation, the river swung to and fro, flowing first into the Gulf and

then into the inland lake. The long intervals of time between, however, permitted the removal of the water by evaporation until finally a basin-like valley, now known as the Imperial Valley, some 40 miles in width and 80 miles in length, with its lowest point approximately 250 feet below sea level, is the result.

Though, due to the very meagre annual rainfall, this valley was one of the worst sections of desert traversed by the early pioneers, an ample water supply will make possible the irrigation of approximately a million acres of land unexcelled in richness within the United States.

Some 25 years ago a group of men with keen vision and faith in their convictions sensed the possibilities of this land, and after tremendous effort were successful in constructing the necessary works to bring water from the Colorado River to irrigate a part of the Imperial Valley. Today the results of such foresight and enterprise are shown by 462,000 acres of land reclaimed and under cultivation, a population of over 60,000 people with several well-built cities and an assessed property valuation of over \$100,000,000.

#### *Other Reclamation Projects*

On the Arizona side, directly east of the Imperial Valley, is an equally fertile section of approximately 110,000 acres known as the Yuma Valley, and in addition, at various locations on both sides of the Lower River, are several projects including the Parker Project, 110,000 acres; the Palo Verde Valley, 78,600 acres; the Mohave Valley, 34,000 acres and the Cibola Valley with 16,000 acres; all of which, immediately adjacent to the river banks, have been formed by the deposition of silt. This land is extremely fertile and in a climate productive to the best form of agricultural development.

#### *Flood Menace and Damage*

The achievement in reclaiming the Imperial Valley has not been lightly won. The Colorado River, flowing along the eastern rim of the valley, has deposited a large portion of its silt along its bed, raising the level nearly a foot per annum until the river now flows on top of a silt ridge 300 feet above the lowest point of the valley.

Protective works of the levee type have been constructed at great expense to prevent the waters of the Colorado from returning to the valley. These have proved inadequate, and in 1905 and 1906 the river breaking through flowed for 18 months into the valley, forming the present Salton Sea, and in addition not only destroyed a large amount of property and land but entailed an expense of some \$4,000,000 before it was again controlled and confined to its banks. Prior to and including the year 1924, more than \$10,000,000 was expended for flood protection alone, and this expense continues. Each year the people of the valley are called upon to spend large sums of money for the maintenance and repair, and also the raising and extension of these levees. In addition to these expenses the annual cost for the removal of silt from their irrigating ditches and from their lands is approximately \$1,350,000.

Finally the silt-formed delta has reached a condition whereby the river is now filling the last available depression into which it is possible to be guided by the hand of man. When this depression is filled, estimated by various authorities from 5 to 15 years, it may be practically impossible to withhold the river against turning and again flowing into the Imperial Valley, destroying by flood the almost superhuman efforts of the past 25 years. A destruction differing from that of the

Mississippi floods in that the only way that the water could be removed would be by evaporation, necessarily taking many years for its accomplishment.

Both the Yuma and Palo Verde Projects have been also subjected to disastrous floods within the past 20 years, causing great damage to property and crops on each occasion, the last one causing over \$2,000,000 damage to the Palo Verde Project alone. The Mohave Project, after large amounts had been expended for levees, was forced to abandon further work due to their inability to provide protection from the flood menace.

#### *Mexican Situation*

During the early development of the Imperial Valley the finances were limited. In order to reduce the first cost an agreement was entered into with the Republic of Mexico, whereby a canal could be constructed with its diversion within the United States but immediately passing for a distance of 60 miles through the Republic of Mexico before again returning across the boundary to the lands of the Imperial Valley. As the price for this concession by the Mexican Government, the American farmers were forced to agree that Mexican lands would be entitled to one-half the flow through the canal. With the present area under direct irrigation of 462,000 acres in the Imperial Valley and 217,000 acres in Mexico, the low flow of the river is inadequate for all. This was clearly shown in 1924, when the total flow in the river was below 1300 second feet and for 76 days every drop of water in the river was diverted. It is also apparent that under such conditions, if Mexico insists on her present plans of development and one-half of the water, then for each additional acre placed under cultivation in Mexico an acre in the Imperial Valley must

return to desert conditions unless there is storage and regulation of the flood waters.

The extremely serious situation of Imperial Valley may be appreciated by pointing out that this canal forms the only possible source of water for not only irrigation but for domestic use, and if interfered with for only a week it would mean not only financial ruin by destruction of crops, but the entire population and all live stock would have to be removed from the valley.

#### *Domestic Water*

The phenomenal growth of Los Angeles and the coastal cities of Southern California since the war has resulted in such an increase in the consumption of water for domestic and commercial purposes that the limit of the available supply is dangerously close to complete absorption.

In 1906 the city of Los Angeles began construction of an aqueduct to bring water from the Sierra Nevada Mountains 250 miles away for the use of its inhabitants. At that time the population of the city was approximately 160,000. It was estimated that the aqueduct would supply a sufficient quantity of water for a population of 2,000,000 and at the rate of growth it would certainly last for many years before this population was reached. Today with a population of over 1,200,000 and with the rapid growth continuing, urgent haste is necessary in obtaining an additional source of supply. This same condition, due to the rapid increase in population, exists in the surrounding communities and cities now dependent upon the small streams available and the percolation of flood waters into the underground gravel, a supply rapidly approaching complete utilization.

With this urgent necessity in mind, these cities, including Los Angeles,

have made careful investigation as to the available sources of additional supply and find that the Colorado River furnishes the only source of sufficient magnitude to meet their necessities for an appreciable length of time. Filings have been made for the appropriation of 1500 second feet for domestic use in the cities above mentioned, and the formation of a metropolitan water district to finance the proposed \$150,000,000 aqueduct project for carrying this water from the Colorado to the coastal plain cities has been formed. The city of Los Angeles has voted and expended nearly \$2,000,000 on preliminary engineering rightsof way.

#### *Government Recognizes Necessity*

Due to the magnitude of the project necessary to furnish relief from the flood menace and to provide the necessary storage and regulation of the flood waters as well as the large quantity of silt, appeal was made to the United States Government for assistance. That the problem demanded solution and immediate action by the Government was very clearly stated by Dr. Hubert Work, Secretary of the Interior, in his report to the Committee on Irrigation and Reclamation of the House of Representatives, on March 17, 1924, when he said:

The Colorado River has been under observation, survey and study, and the subject of reports to Congress since the close of the Civil War. More than \$350,000 have been expended by the Bureau of Reclamation since the Kinkaid Act of May 18, 1920. More than \$2,000,000 have been expended by other agencies of the Government. The time has arrived when the Government should decide whether it will proceed to convert this natural menace into a national resource.

#### *Government Plans for Relief*

As indicated by the Secretary of the Interior in his report referred to above,

the United States Government has expended large sums of money in an investigation looking toward the best solution of the problems comprising flood and silt control, storage and regulation of flood waters for irrigation and domestic uses. The first and preliminary report made public was the so-called Fall-Davis Report published as Senate Document 142, 67th Congress, 2nd Session. The latest and most comprehensive report is the Weymouth Report to the Secretary of the Interior dated February, 1924, together with the supplemental report of June, 1924. This report incorporates a careful analysis and study of the resources and possible development of the entire river below the junction of the Green and the Colorado River.

Complete development, under the comprehensive plan thus determined, of which the proposed Boulder Canyon Project is a part, will result in the minimum amount of water lost by evaporation from the storage reservoirs and the maximum amount of hydroelectric power equaling 6,800,000 horsepower of peak capacity. The report shows further, that the first logical step in the program and the one providing the maximum amount of relief in the immediate crisis would be the building of the proposed dam in the main stream of the Colorado at the lower site of the so-called Boulder Canyon Storage Project, approximately 30 miles east of Las Vegas, Nevada; the river at this point forming the boundary line between the states of Arizona and Nevada.

#### CHARACTER OF PROJECT

##### *General Description*

The Boulder Canyon storage location furnishes one of the most remarkable dam sites in the United States as the walls rise abruptly to a height of



approximately 1000 feet, forming a narrow gorge. The foundation rock is admirably suited in every way for the construction of such a structure. It also provides a natural reservoir site which could, if necessity should demand it at any future time, provide a storage capacity of perhaps twice that now contemplated. The present plan of the Reclamation Service calls for a dam 550 feet in height above the low water level of the river, which would impound in the storage reservoir approximately 26,000,000 acre feet of water. With bed rock of approximately 110 feet below the present low water of the river, the total height of the dam structure will be 660 feet, a material increase over the highest dam now in existence. The tentative design as prepared calls for a structure of the gravity type arched up stream, a length at the foundation of 275 feet at the present low water line and across the top of the dam of 1100 feet.

Although such a structure is a new adventure in magnitude of design, it is well to remember that the engineers of the Reclamation Service who will build the dam under Government plans have also designed and built not only more dams than any other organization in the United States but practically all of the larger ones. Careful investigation has been made as to the type of structure and estimates prepared on the cost for both rock fill and concrete designs.

Adequate spillways will be provided by means of tunnels through the rock wall on the Arizona side to a small side canyon which enters the river a short distance below the dam. The cost of a 550-foot dam complete is estimated to be \$41,500,000 exclusive of interest during construction.

#### *Hydro-Electric Power*

The United States Reclamation Service, in its early conceptions of the plan

for the proposed Boulder Canyon Project, realized that there would be incident to the Project an opportunity for the development of a large block of hydro-electric power. Investigations as to probable power market were made and resulted in ample assurance that conditions were such that there would be a market for the power and that the revenue from that source would be sufficient to repay the Federal Government for its total investment in the Project, over a period of years, with interest, and also the cost of operation and maintenance.

Accordingly, the Secretary of the Interior has caused to be written into the proposed legislation alternative methods of providing for revenue from the power. One plan contemplates that the Government itself build a power plant of approximately one million horsepower installed capacity. The average or firm horsepower, if generated continuously day and night through the year, would be approximately 550,000 horsepower, hence a one million horsepower generating plant would carry peak loads during the hours of heavy demand such that the average load would be 55 per cent of the peak; that is, the power would be developed on a 55 per cent load factor.

The investigations and reports referred to estimate the cost of the power plant to be \$31,500,000, exclusive of interest during construction, and it is proposed that the Government sell the power at the switchboard of the power plant at a price that will cover the cost of operation and maintenance and the repayment to the Government of the cost of the storage and power project combined over a period of years, with interest. The plan, therefore, contemplates that the Federal Government would loan its credit but be fully reimbursed for its investment, with interest, and the proposed legisla-

tion requires the Secretary of the Interior to enter into firm contracts for power, sufficient to provide complete reimbursement to the Federal Government, before the expenditure of any money for the construction of the project.

#### *Alternative Power Program*

In order that the Secretary of the Interior, who would be directly responsible for the financial success of the undertaking, might be assured of every assistance in the working out of such a plan, the proposed legislation contemplates that he may, in lieu of selling the power at the switchboard, lease units in the Government constructed plant, or at his discretion lease the right to develop power by means of the water discharged from the dam to applicants who would then build, under Government supervision, their own plants for the development of hydro-electric power, thus relieving the Government of this portion of the investment. Proceeds from the sale of power rights would take the place of revenue from power and be used in the amortization of the cost of the dam structure and project.

#### *All-American Canal*

In addition to constructing the above-mentioned project at Boulder Canyon, and in order to relieve the Imperial Valley from its present dependence on Mexico, the plan contemplates the construction of a so-called All-American Canal, approximately 60 miles in length, which would lie entirely within the United States. In the plans for this canal it is proposed to move the point of diversion to the present Laguna Dam, some 12 miles above the city of Yuma. At the time this dam was constructed the Imperial Valley entered into a contract with the United States Government and agreed

to pay and is paying for the privilege of this diversion \$1,600,000 out of a total cost for the dam of \$2,180,000. This will also enable the water to be taken out at a much higher level, making possible the irrigation at some future time of some 500,000 acres of additional land lying in the Imperial and Coachella Valleys.

A board appointed under an agreement between the Secretary of the Interior and the Board of Directors of the Imperial Irrigation District, composed of Dr. Elwood Mead, now Commissioner of Reclamation, C. E. Grunsky, consulting engineer of national reputation, and W. W. Schlecht, Engineer of the Reclamation Service, made a complete report including estimate on the cost of such canal, and also reported favorably as to its feasibility and desirability. In addition to this board, engineers of high standing have, with practical unanimity, after thorough investigation, endorsed the plan for such a canal.

The estimated cost of the all-American Canal is \$31,000,000, exclusive of interest during construction. Although this appears large, the cost per acre for all construction charges as determined by the Secretary of the Interior including the present bonded indebtedness of the Imperial Irrigation District of \$25.50 will be as follows:

Imperial Irrigation District.....	\$66.00
New lands under All-American Canal	90.40

When these figures are contrasted with the average construction costs of present reclamation projects they show the reasonableness and feasibility of such a project from the cost standpoint.

While the urgency of this canal cannot be questioned, yet it must be considered that it is wholly infeasible without control of flood waters and the storage reservoir for the removal of silt and the regulation of flood waters according to an irrigation program.

The Secretary of the Interior at the request of Congress submitted a proposed plan of development financed through the sale of the hydro-electric power, including a 550-foot dam and a one million horsepower plant, together with the All-American Canal, as follows:

<i>As to cost for:</i>	
26,000,000 acre foot reservoir	\$41,500,000
1,000,000 horse power development	31,500,000
All-American Canal	31,000,000
Interest during construction, 5 yrs. @ 4%	21,000,000
<b>Total</b>	<b>\$125,000,000</b>
<i>As to revenues—annual operation:</i>	
Sale 3.6 billion kilowatt hours @ 3/10c	\$10,800,000
Storage and delivery of water for irrigation and domestic purposes	1,500,000
<b>Total</b>	<b>\$12,300,000</b>
<i>As to annual fixed charges for operation and maintenance, storage and power:</i>	
Operation and maintenance, All-American Canal	500,000
Interest on \$125,000,000 @ 4%	5,000,000
<b>Total</b>	<b>\$6,200,000</b>
Estimated annual surplus or sufficient to repay the entire cost in 25 years	\$6,100,000

From the above it is apparent that the proposed plan is absolutely feasible from a financial point of view.

#### SIGNIFICANCE TO THE SOUTHWEST

##### *Agriculture*

The controlling of the floods and the storage and regulation of these waters will permit of the ultimate irrigation of lands in the states of Nevada, Arizona and California totaling approximately 1,750,000 acres including lands already under irrigation.

As the available water supply of Southern California for irrigation pur-

poses is practically exhausted, and with the rapidly growing population, it is evident that these additional lands will be required in the future along with a growing demand for farm products from other sections to feed the rapidly growing market of the Pacific Coast as well as the local markets in the states of Arizona and Nevada.

##### *Manufacture*

One of the most potent factors in the building up of an industrial community, and next to its supply of domestic water, is the ability to furnish its institutions cheap electric power. The construction of the dam will make available 1,000,000 horsepower of cheap hydro-electric power to the industrial markets of Arizona, Nevada and California, with its natural impetus toward increasing the production of present plants and the attraction of additional industries to the communities. Experience shows that as our population and industrial activity along our special lines increase our demand for food and manufactured articles from other parts of the country increases in even greater proportion.

##### *Domestic Water*

The storage of the flood waters and the removal of silt by the reservoir will furnish a supply of portable water for the cities of Southern California, and without which their growth must, at the present rate of increase, abruptly cease. It is, therefore, imperative that if the Southwest is to grow, additional water must be procured and the only available source is the Colorado River.

#### SIGNIFICANCE TO THE COUNTRY AS A WHOLE

The construction of the Boulder Canyon Project will have a decided bearing and significance to the country

at large as it will necessarily call for large quantities of construction material and equipment, practically all of which must be at present supplied from eastern markets. Large blocks of cheap power, permitting the growth of industry in the Southwest, will add materially to the shipment of commodities both raw and finished between the east and west.

As the land is placed under cultivation, in addition to supplying the local markets of the Southwest, due to the practically all-year growing season, it would be possible to ship to the eastern markets produce and staple vegetables at a time when they can be obtained from no other source in sufficient quantity except from foreign countries.

The construction of the All-American Canal and regulation by the storage reservoir will unquestionably stop Mexican interests from adding materially

to land they now have under cultivation, which is practically all utilized in the growing of cotton. This cotton is grown in Mexico not only by cheap foreign labor but enters the American market to compete with American grown cotton. While it has been feared that Imperial Valley lands would be used for the growing of cotton it is found by experience that they are better suited both climatically and financially to the growing of vegetables and similar commodities, and as pointed out these will either be used locally or enter the eastern market at a time when eastern farmers could not possibly supply them, and, therefore, they will not interfere with the present farming industry. The development of new lands by irrigation necessarily will be slow and will not equal an equivalent of the growing markets of this section.



## Problems of the Colorado River

### Relative Advantages of the Boulder Site

By ARTHUR P. DAVIS

Chief Engineer and General Manager, East Bay Municipality District, Oakland, California

THE Colorado River is one of the large and important rivers of this country, but has a very fluctuating discharge, due to changing seasons and changing years. If completely regulated its magnitude is sufficient to furnish an ample domestic supply of water to all the inhabitants of the United States, and a considerable margin over. The low water flow of the river during the latter part of summer and autumn, is all utilized in irrigation, and the development has proceeded to a point where in the drier years there is a serious shortage of water during September and October for lands already under cultivation; but the spring and early summer furnish vast quantities of flood water that not only run to waste, but do great damage to lands along the banks of the river, and especially in the Imperial Valley, which being an interior basin, if flooded, would be permanently destroyed. The imminence of such destruction is the occasion of the urgency of this problem.

The problem of changing the Colorado River from a natural peril to a national asset, is mainly a problem of water storage. Reservoir sites of large capacity have been examined and found feasible on the upper tributaries of the Colorado, and while these can partially regulate these tributaries, and assist in their development, they are not large enough nor properly located for complete control and development of the river. The bulk of the storage

capacity must be provided within or below the canyon region where it can intercept most of the entire flow of the basin. Otherwise, the waters will be largely wasted as at present, and continue to be a menace to the valleys on the lower river, which will probably be destroyed if regulation is not accomplished in the near future.

The only site of sufficient capacity and properly located to accomplish all these results is at Boulder Canyon, where it is feasible to construct a reservoir to any capacity from 20,000,000 to 45,000,000 acre feet, and while completely regulating the river at that point, at the same time will develop sufficient power to pay for itself. Aside from its paramount virtues in water regulation for irrigation and flood protection there is no other plan of development which will produce power so cheaply as a large reservoir in Boulder Canyon such as proposed.

#### ACTIVE OPPOSITION

It was first vigorously asserted by the opponents of Boulder Canyon Reservoir that 600,000 horse power developed at Boulder Canyon could not be absorbed by the available market for power for twenty years, and that in the meantime the interest charges would accumulate to such an extent as to make the development prohibitive. Finally the matter was referred to Mr. L. S. Ready and Mr. H. G. Butler, who made a thorough

examination of the subject, and proved that if the Boulder Canyon power were immediately provided, the power developed would be absorbed within three or four years after it could be produced.

#### OTHER SCHEMES FATAL TO CHEAP POWER

Notwithstanding this authoritative finding, the opponents are still expressing doubts as to the wisdom of so large a development and repeating their former recommendations that the river should be developed by a series of small dams. As represented by actual schemes of construction submitted, five dams are proposed of heights, respectively 158 feet, 163, 194, 209, 223 and 225 feet, in portions of the canyon where much larger development would be far more economical. Such development would be fatal to cheap power.

In general, the power developed by means of a low dam in the Colorado Canyon is far more expensive per unit than the power produced by a high dam. In either case, the floods of the river must be controlled to permit the excavation of foundations, which are everywhere deep. These control works cost as much for a low dam as for a high dam. The same is true of the railroad which must be built to convey materials and machinery to the site, which is in any case, a heavy expense. This also is largely true of the great construction plant; while the production of power by a low dam would be less in proportion to the height of dam, due to the better regulating effect of the water by the wider pond produced by the high dam, and the fact that each reservoir must be provided with a margin for the rise and fall of floods, above its top without interfering with the next development above.

#### POWER 30 PER CENT CHEAPER AT BOULDER

Careful estimates of cost, based upon extensive surveys at the Boulder Canyon site, show that a dam 555 feet high, proposed, will develop power nearly 30 per cent cheaper per unit than a dam 50 feet lower.

A still lower dam would be similarly more expensive per unit of power produced and in varying degrees the same principle applies to the development of any power site in the canyon region within the limits of feasible height of construction. Under such a plan power development on the Colorado would be no longer a menace to the investments in future power sites in the Sierras, for it would make the cost of Boulder Canyon power about as great as that produced in the Sierras, and it is such development as this that may be expected if it is turned over to private exploitation. This would largely destroy the great natural asset which the Nation owns in the power possibilities of the canyons of the Colorado.

One criticism of the Boulder Canyon plan is that a high dam would produce so large a pond that the losses by evaporation would be excessive and that the reduction of the floods to a maximum of 40,000 cubic feet per second as proposed is not necessary, but that a reduction to 80,000 would do about as well. A fair summary of the argument is that it is unwise to store this water because the reservoir would lose part of it by evaporation, and that it is better to allow the floods to continue to flow to the sea unused and to fight them on the way by means of high levees and other expensive and perilous provisions.

#### DAM IN MOHAVE CANYON

The same authority proposes to substitute for the Boulder Canyon

storage, a reservoir in Mohave Canyon, which would have a much larger water surface and entail about 75 per cent more evaporation in proportion to water stored. It would also submerge the city of Needles, the large railroad hotel, round-house, machine shops, large icing plants, twenty-four miles of yard track and twenty miles of double track main line, and the length of the transcontinental railroad would be increased about three miles. It would require the reconstruction of a similar length of the Santa Fe Trail highway and two great bridges across the Colorado River. It would also submerge over 30,000 acres of excellent land in the Mohave Valley, susceptible of easy irrigation, after the river is controlled, which could not be replaced. It is true other areas could be irrigated with the same water, but these other areas can only be reached by expensive canals, long tunnels and high pumping lifts, which would cost \$200 per acre, or more, for construction, and incur prohibitive prices for operation and maintenance. Such enterprises are not feasible now, and may never be, and while it is wise not to prejudice their future possibilities, the argument that they justify the destruction of rich bottom land along the river is untenable and destructive of natural resources.

The dam in Mohave Canyon that would entail all of this destruction would produce very little power because of lack of head. It would be the most expensive power site in the Colorado Canyon that is seriously proposed by anybody, being more than double the cost per horse power of the proposed development in Boulder Canyon, besides its enormous evaporation losses. Its construction would be a signal victory for anyone opposed to the development of cheap power on the Colorado.

#### GLENN CANYON PROJECT IMPRACTICABLE

The Boulder Canyon development has been antagonized by a proposition to build a large reservoir in Glenn Canyon in northeastern Arizona, nearly twice as far from the principal markets and much more expensive in construction. Estimates of relative costs show that the development of power in Glenn Canyon would be nearly twice as expensive per unit as in Boulder Canyon, and the cost of transmission to points of use would be fully twice as great. The Glenn Canyon Reservoir would not solve the flood control problem, because it would leave uncontrolled about 50,000 square miles of mountainous drainage between Glenn Canyon and Boulder Canyon, which would leave the flood menace very dangerous. The power produced, while much more expensive, would be less reliable, owing to the enormous length of transmission line through country remote from construction and maintenance facilities.

#### SALT DEPOSITS

One of the objections heard is the allegation that the Boulder Canyon Reservoir would be rendered unfit for irrigation or domestic use by reason of salt deposits that occur therein. This question was thoroughly investigated by an eminent geologist of the United States Geological Survey, who reported that the quantity of salt, as compared with the volume of water, was negligible, and that in any event a brief period of solution would so undermine the overlying earth that it would cave in and cover up the deposits before any injurious amount could be dissolved. All competent experts who have examined this subject are agreed with Professor Ransom in the above conclusions and their

opinions have been duly published and made available to the public.

One after another of the objections to the Boulder Canyon development have been met and refuted, but regularly they are reiterated or new objec-

tions are invented. It is hardly possible that the ingenuity of the objectors has been entirely exhausted, and the interests involved are too great to allow us to expect universal acquiescence in the plan proposed.



# What the Boulder Dam Project Means to California and to the Nation

By CLYDE L. SEAVEY

Member of the California State Railroad Commission

OUT of many years of investigation by responsible Federal agencies and as a result of probably the most exhaustive course of hearings before Congressional Committees ever accorded any work of internal improvement, the so-called Boulder Dam Project for a development of the lower Colorado River has taken definite form. It contemplates the construction by the Federal Government of a great dam on the Colorado where that river forms the boundary line between the states of Arizona and Nevada and where there is not only a remarkably fine site for a dam but where there is also an exceptionally advantageous reservoir site. Under the plans for this development the dam will be 550 feet in height and will create a reservoir with a capacity of 26,000,000 acre feet. The estimated cost of the dam is \$41,000,000, which means a cost per acre foot of storage capacity of but \$1.58.

The project also embraces the construction of what is termed "The All-American Canal," being a canal running from the river to the Imperial Valley in California and located entirely to the north of the international boundary line between Mexico and the United States. The estimated cost of this canal is \$31,000,000. As this estimate was based upon price levels existing nearly ten years ago and was made before the advent of improved methods of excavating on a large scale, it may safely be said that the cost of this portion of the project will be sub-

stantially less than the estimated figure.

## WHY THE DEVELOPMENT

This development is a unified development and is intended to subserve a variety of purposes with the minimum of cost.

To understand these and the reasons why the development has taken the form it has, requires a general understanding of the characteristics of the Colorado River and of the Imperial Valley.

The river is one of great fluctuation in flow, both annual and seasonal. Sometimes it discharges as high as 25,000,000 acre feet of water in a single year. The next year its total discharge may be as low as 9,000,000 acre feet. The seasonal variation in rate of flow is even more pronounced, ranging from 200,000 cubic feet per second, when in flood, to as low as 1250 cubic feet during the low water season.

The river rises in the high mountains of Wyoming and Colorado. Its mouth is the Gulf of California. Melting snow and rainfall from the mountain ranges are the principal sources of the river's run-off. The lower portion of the Colorado River Basin is made up of hot arid plains of low altitude, broken by short mountain groups. The central portion consists of a high rocky plateau, through which the river flows in a series of deep and narrow gorges.

Centuries ago what is now the Imperial Valley was a portion of the north-

ern end of the Gulf of California. The river, as it runs through the canyon region, picks up a tremendous amount of silt or sediment. In volume, this amounts to over 100,000 acre feet each year. Gradually the deposit of this sediment built a delta across the Gulf of California. There was thus left a great inland sea which was gradually unwatered by the slow process of evaporation. In this great bowl in the desert there has been built up an irrigated area of over 450,000 acres, populated by some 60,000 people and known as Imperial Valley. This valley actually lies from 250 to 300 feet below the channel of the Colorado River. The river runs along the rim of the bowl, until it finds its way into the Gulf.

This brief statement of the existing physical conditions indicates a flood danger to the Imperial Valley region, the seriousness of which cannot be overestimated. In 1905 the Colorado River did break from its channel along the delta and flowed into Imperial Valley. By almost superhuman efforts the river was restored to its old channel and directed to the Gulf of California. Just when another break will occur no one knows. It is known that year by year as the river piles up its volume of silt along its varying channels across the delta the imminence of the break becomes greater and greater.

To all of the Government officials who have investigated the situation thus adverted to, it has been obvious that the solution of the flood problem lay in the construction of a regulating dam up the river where there might be found both an appropriate site for a dam and an appropriate site for a reservoir. Such a dam would intercept the flood waters of the river and permit of their being released at times when the channel could safely carry

them to the Gulf of California. Perhaps even more important than this was the fact that such a dam would intercept the silt of the river and thus prevent the gradual filling up of any natural depressions across the delta by which the water of the river may be conducted to the Gulf.

Just as it was obvious that the construction of such a dam furnished the remedy for the flood menace to Imperial Valley, just so it was apparent that the expense of such a dam was beyond the ability of the Imperial Valley to undertake and was probably of such magnitude that the Congress of the United States would long hesitate to authorize it as a direct and unreimbursible outlay.

Out of this situation developed the idea of a unified development by which the dam and reservoir would be of sufficient size and capacity not only to provide for flood control but also for future irrigation requirements of the lower Colorado River Basin and to make possible a power development, thus providing sources for a full reimbursement to the government of the cost sustained.

After the plan of such a unified development had assumed rather definite form a new interest arose of far-reaching public importance and one which made the development an even sounder one in its financial aspect than it at first appeared.

Since the census of 1920 the city of Los Angeles and the other cities of the coastal plain of southern California have experienced a tremendous growth in population. At the same time these cities experienced a period of dry years, which demonstrated the inadequacy of their present sources of domestic water supply. These two circumstances coming together caused this section, having a population of probably not less than two millions of

people, to awaken to the imperative necessity of supplementing its existing sources of domestic water supply. Investigations indicated the only practical source of such an additional supply was the Colorado River. To secure such a supply involved not only the building of a great aqueduct over two hundred miles in length from the Colorado River to the coast and the pumping of water to an elevation of over twelve hundred feet, but it also necessitated large storage in the Colorado River in order that there might be sufficient water to supply the needs of the territory tributary to the river and the needs of the coastal plain cities for domestic water, and also to remove certain technical and engineering difficulties in the way of desilting the water to render it susceptible to being pumped the great elevation necessary and its use for domestic purposes. It happened that the Boulder Dam plan of development fitted in ideally with this plan of securing a domestic water supply for the coastal cities. The need of a large amount of hydroelectric power to pump this water over the mountain ranges to the cities on the coast greatly broadened the market available to absorb any power generated at the dam and removed all reasonable doubts as to there being an available market to absorb any power which might be developed.

At the present time the Imperial Valley secures its sole supply of domestic and irrigation water by means of a canal which starts at the Colorado River a few miles north of the international boundary line and then proceeds in a rough semicircle for about sixty miles through the Republic of Mexico before reëntering the valley and delivering water to the lands on the American side of the international line. There are some 800,000 acres of land in Mexico tributary to this canal,

owned almost entirely by American capitalists, which has been developing more rapidly than has the Imperial Valley and under circumstances both unfair and detrimental to the interests of irrigationists in the United States. The very existence of such a canal extending through a foreign country is conducive to international inharmony and trouble. Furthermore, the rapidly increasing draft upon the water carried by this canal for irrigation in Mexico coming on top of increased irrigation uses in Colorado, Utah and Wyoming frequently leaves the Imperial Valley subject to serious water shortages. Provision of large storage on the Colorado River in the United States, with nothing more, would leave this great area of land in Mexico as the chief beneficiary of the development because of the increased water supply which would come from river regulation and which increased supply would be available to Mexican land before reaching the Imperial Valley. The All-American Canal not only will solve a vexatious international situation but will relieve Imperial Valley from danger of water shortage and, together with the control of the release of water from the dam and reservoir, will give the United States strategic control of the waters of the Colorado River so that Mexican interests will not be able, against the will of the United States, to lay the foundations of claims to an undue proportion of the waters of the river.

That this development means a great deal to California goes without saying. But what it means to California it means in a greater or less degree to Arizona and Nevada.

It means that the Imperial Valley, in southern California, a valley made up of a sturdy pioneer stock of Americans, will be freed from the ever present menace of destruction by flood.

Proportionally, it means as much to the people of Yuma, Arizona, where there is a National Reclamation project, because this section, too, is subject to the menace of the Colorado River floods.

It means that the Imperial Valley will be freed from its present intolerable condition of securing its sole supply of water from a canal running through a foreign country.

It means, too, that this valley will no longer be faced with the danger of a water shortage—a danger hardly less serious than that of destruction by flood, since in that desert country nothing can live without water.

It means that the flood and waste waters of the river will be conserved and made available for future irrigation development in California, Arizona and Nevada. While plans for such development are more advanced in California than in the other states, relatively the advantage to the other states will be greater.

It means that there will be made available a large block of dependable hydro-electric power urgently needed in California but which relatively will be of greater advantage to the states of Arizona and Nevada, because these states, generally speaking, are not in as advantageous a position as is California in respect to steam power.

It will open the way to the coastal plain cities of southern California, securing an additional and imperatively needed domestic water supply.

Under the plan of development, which contemplates the Government *either building power plants at the dam and selling power at the switchboard or leasing the fall of the water to applicants for the generation of power*, danger of a monopolization of the power resources of the lower Colorado River is forever safeguarded against, as the whole scheme contemplates that the power or

power privileges will be divided amongst various applicants. A monopolization of the power of the lower Colorado would mean that the agency securing it would be in a position of dominance in the industrial and political life of the Southwest.

#### NATIONAL ADVANTAGES

While the Boulder Canyon development will be of tremendous benefit to California, Arizona and Nevada, it is a mistake to think of it as a matter of merely local consequence. Works of internal improvement must be accomplished in steps, and each step is usually of more immediate importance to the section in proximity to it than to other sections of the country. The taking over of the Cape Cod Canal by the Federal Government was of more immediate consequence to portions of New England than to the South or Middle West or the Pacific Coast. Improvement of the Mississippi has its immediate beneficial effect upon regions lying in the valley of that great river. The proposed St. Lawrence development affects one section of the country more directly than another.

The nation as a whole is interested in this development because, among other things, it solves a vexatious international situation. It is perfectly obvious that sooner or later the Colorado River will be developed. By reason of the fact that the canal serving Imperial Valley passes through Mexico, unless this development is shaped on sound lines Mexican lands will be the chief beneficiaries and claims and rights will be created which may prove in the future extremely detrimental to American interests. The plan of the Boulder Dam development will put the United States in control of the waters of an American river and insure that waters conserved by the development



may be used in this country rather than in a foreign country.

This project is the first step in the development of a great river having tremendous possibilities. If developed in the public interest and on sound lines it has tremendous potentialities for good to the Southwest. The consummation of the Boulder Dam project means that the river will be developed in the public interest. For example, it insures the use of the waters for river regulation and irrigation in preference to use for power generation. The importance of this in a section dependent upon water for its agricultural growth can hardly be overestimated.

#### ALL COSTS TO BE REFUNDED

Perhaps the most interesting feature of the development lies in the financial scheme upon which it is built. This represents a distinct departure from anything heretofore attempted. Thus far in the history of this country Federal internal improvements have represented either an unreimbursed outlay from the National Treasury or an advance of funds to be reimbursed without interest, as in the case of reclamation projects. Here there is to be a complete reimbursement with interest. Even more significant than this is the unusual requirement that before any work is undertaken or any expenditure made the development must be completely underwritten by its beneficiaries. Firm contracts for the storage and delivery of water for irrigation and for domestic use and for the purchase of power and power privileges must be secured by the Government in advance of construction. As various responsible agencies are eager to contract for water and for power, this development, if authorized, will be of assured and demonstrated financial integrity.

#### THE OBJECTORS

Unfortunately, a consideration on its merits of this great work of internal improvement is liable to be prevented by the bitter struggle which is now centering about it. Private power interests, desirous of securing for themselves a complete monopolization of the tremendous hydro-electric possibilities of the lower Colorado River, unhampered by obligations respecting river regulation and use of water for irrigation, have launched a determined attack upon this development because it means that power will not be monopolized and that the waters of the river are first dedicated to river regulation and irrigation. Men influential in the business and political life of the Southwest who own or control vast areas of land in Mexico are bitterly opposed to this development, because it stands in the way of their securing special advantage to their great holdings. Each of these interests would have the Government make an unreimbursed outlay of some \$25,000,000 for a low flood control dam, for such a dam would leave the hydro-electric resources of the river open to acquisition by the power interests and would redound to the benefit of owners of land in Mexico, as it would eliminate an all-American canal and in a practical way insure increased deliveries of water at periods when water is now approaching the point of shortage.

On top of this the situation has been further complicated by a resuscitation by certain of the intermountain states of the old doctrine of states' rights, a doctrine which has been conveniently forgotten by them during the long period when they were securing extensive assistance from the Federal Government in reclamation projects. These states are invoking this doctrine as a ground or pretext for claiming large

revenue from the development of the river, claims which, if recognized, would render the whole project unsound from a financial standpoint.

The next few months will witness a bitter and dramatic struggle over this

development, the outcome of which will afford an interesting indication of the ability or inability of the American people to develop one of its great natural resources in the public interest.

# My Objections to the Boulder Dam Project

By HON. E. O. LEATHERWOOD

Congressman, Utah

I HAVE been asked to state why I am opposed to the Boulder Canyon Dam project as it is proposed to be authorized in what is known as the Swing-Johnson Bill before the Congress of the United States. I can answer the question in one sentence. It is dishonest, dangerous, unsound and unnecessary legislation.

It is dishonest because it is masquerading under false colors. It purports to be a flood control and reclamation project but is, in fact, a government-ownership power project, which only incidentally provides some, but inadequate, flood control, and which may, if agricultural conditions improve, at some future time result in some irrigation development.

It is dangerous in two large aspects: first, because it subverts the relation between the national and state governments in that it would subordinate to national control the state control over the waters of the streams within the borders of the states themselves, and it would establish the precedent for federal bureaucratic control over vital industrial resources of the states; second, it would establish the dangerous precedent that the federal government may, in carrying out a legitimate function, undertake a business enterprise having no relation to its legitimate function except that the business enterprise is undertaken in the hope that profits therefrom will enable the federal government to pay the expense of the legitimate function.

It is unsound in the legal theory upon which it is based, namely, that the federal government may, under the guise of doing one thing, do an

entirely different thing. It is further unsound in its economic, engineering and financial bases. It represents a political solution of what is essentially an engineering problem.

It is unnecessary because the regulation of the flow of the Colorado River in its lower basin calls for an expenditure of no such magnitude, nor for the risk of the taxpayer's money in an expenditure for the production of electric power for which there is no adequate market either now or in a practical future period.

Let us proceed to discuss the proof of the foregoing assertions.

## THE BOULDER CANYON DAM BILL IS DISHONEST

This bill has been repeatedly represented by its authors on the floor of both Houses of Congress, as well as by that powerful chain of newspapers which propagandizes on its behalf, as a flood control bill for the protection of the Imperial Valley in California. The danger and distress of the Imperial Valley have been described in harrowing terms, and it is on this appeal to country-wide human sympathy for sixty thousand lives and thousands of homes in danger from the floods of the "torrential Colorado" that chief reliance has been placed to arouse popular support. The danger is represented as being an imminent one calling for immediate preventive action.

In the face of these assertions as to flood danger, the following are the facts: First, there is no danger to human life involved in this flood menace, and there is, indeed, no danger to property

in the ordinary understanding of danger from a flood. Whereas the ordinary river flood means the sudden inundation of large areas and the flooding out of farms and homes, the flood waters of the Colorado would, during the first few months of a flood, inundate no homes or farms in the United States, but would simply flow into the existing inland sea known as the Salton Sea and very gradually raise the level of that sea. The annual flood of the Colorado is caused by the melting snows and does not last for a longer period than three months. At the end of that period the river subsides to a flow at which, through the present equipment for fighting it, it could very probably be again controlled and rediverted from its flow into the Salton Sea. 'Three months' or even a year's flow of the Colorado into the Salton Sea would cause no substantial damage to property. It is, therefore, rank misrepresentation to picture the flood danger to Imperial Valley as the ordinarily understood flood danger from other rivers in the country.

A dam which will also provide the necessary storage for silt and for water for irrigation purposes can be constructed at a cost of not to exceed \$15,000,000. Flood control alone, without storage, that is, through channel dredging and levee construction, can be provided at a cost not to exceed \$6,000,000. The cost of the project to be authorized in the present Boulder Canyon Dam Bill is estimated at \$125,000,000, and its probable cost will be double that amount. The storage required for flood control is estimated at from 4,000,000 to 8,000,000 acre feet. The storage provided for in this project is 26,000,000 acre feet. Here, then, we have a bill masquerading as a flood control bill in which nine-tenths of the expenditure and approximately 75 per cent of the

storage are for purposes wholly other than flood control! To represent this as a flood control bill is as to honesty and accuracy on a par with the representation that the annual appropriation of the Interior Department is for the maintenance of national parks, because a fraction of the appropriation goes for that purpose.

It is not primarily either a flood control or irrigation project. These facts were pointed out as long ago as March, 1925, by the three Cabinet officers who passed upon the project and condemned it. I refer to Secretaries Weeks, Work and Wallace and to their letter of March 24, 1925.

We do not, however, have to rely upon the statements of opponents to establish this fact. As recently as September 29, 1927, in the leading press organ for the Boulder Dam Bill, it was stated editorially:

A compelling reason for including the power feature is the domestic water situation in Southern California. Los Angeles and twenty-seven other cities are applicants for Colorado River water. They must draw upon this in the not distant future. They stand ready to pay for it. But the only way to get it is by pumping it, and for this operation the only possible source of sufficiently cheap power is Boulder Dam.

It is true a high dam is not needed for flood control. But a high dam is needed to impound a domestic water supply and to generate the power to pump it.

The mask is now off. This is not a flood control or an irrigation project. It is a power project primarily designed for furnishing power and water to the city of Los Angeles. Upon these facts I submit again that the Boulder Canyon Dam Bill is dishonest.

#### THE PROPOSED LEGISLATION IS DANGEROUS

When I say that this legislation is dangerous I speak advisedly. State



autonomy, the right of states to control the development of economic resources within their borders, has never before in my experience been so seriously challenged as by this legislation. The threat is twofold; first, to take control over the development of the Colorado River, which river flows through seven western states; second, under the guise of carrying out a flood control project to enter into the conduct of a huge business enterprise within the states which will be subject to no state taxation or control, and to take over from the states the right to control the rates at which the manufactured product shall be sold and distributed within their borders.

With the first of these threats, that of taking over control of our western streams by the federal bureaucracy, we have been contending for more than two decades. In the face of decisions contrary to their contention by the United States Supreme Court and by other federal as well as state courts, the Bureau of Reclamation of the Department of the Interior has since its creation persistently asserted a control over the streams in the West which subordinates state authority and prohibits irrigation developments approved by state authorities from proceeding without the consent of this federal bureau. Perhaps the two outstanding bitter experiences which the western states have had in this regard with the federal bureau have been on the North Platte and the Rio Grande Rivers. In connection with the construction of the Pathfinder Dam on the North Platte and the Elephant Butte Dam on the Rio Grande, the Bureau of Reclamation caused the Secretary of the Interior to declare embargoes against developments authorized by the states on the headwaters of those rivers. The areas affected by the embargoes were ready

for development, and citizens of the states were ready and eager to proceed with the developments. Delegation after delegation from the states importuned Congress and the bureau to give them relief against these embargoes, but nothing was done. The embargoes continued for a period of almost twenty-five years. One of them was then declared illegal and lifted, and the other is now ignored. Hence, without any authority from Congress, with no justification in law, and merely through the control over public lands and through a desire to exercise an arbitrary authority in an illegal manner, bureaucratic employees of the federal government have hindered and retarded the development within the states of Colorado, Wyoming, and New Mexico.

The legislation under discussion now proposes to turn over to the Bureau of Reclamation the Colorado River, and to authorize the construction by that bureau upon that river of the largest dam ever attempted in this country or in the world. In the light of experience on the Rio Grande and North Platte Rivers, those of us who live in states which must depend for most of their future development upon the water of the Colorado are keenly aware that we are here faced with a threat of future embargoes upon our state developments. An attempt was made to obviate this danger by negotiation of an agreement between the seven states in the Colorado River Basin, which, when approved by the federal government, would establish the rights of these states in the waters of the river, and at least to a reasonable degree protect against the menace with which we are now faced. That agreement, although drawn and approved by delegates from the various states, has failed of ratification by some of the states and is therefore not in effect.

It is now proposed by the authors of this bill, and with the apparent approval of the Director of the Reclamation Bureau, to attempt to proceed with the building of this dam without any such compact. Relying upon the argument that this project is an interstate matter with certain international complications, it is proposed that Congress should proceed without regard to the protests of the states and without regard to whether the states are protected in their future development. So far as protection against the menace of federal bureaucracy is concerned, we are therefore in the same position as were the States of Colorado, Wyoming and New Mexico in the cases of the developments on the Rio Grande and North Platte. So much for the first menace to state autonomy.

The second danger in this legislation is even more far-reaching and fundamental than is the menace to state control over water. It is a menace to state autonomy throughout the United States. It is a menace to every citizen in the conduct of his everyday business, because in it the hand of federal bureaucracy reaches out and removes from state control a gigantic unit in industry.

To enforce appreciation of this danger I must again point out that this proposed project is not primarily a flood control project but is primarily a hydro-electric power project of the first magnitude. People generally who have given any attention to the project have been misled by its proponents into the belief that it was primarily a flood control and irrigation project which would incidentally, and only incidentally, develop as a by-product a small amount of power which should be disposed of by the government as an incident to its operation of its flood control and irrigation projects. As evi-

dence of this there is the argument repeatedly made by the proponents that this is not the first time the government has built a power plant, because the government has built and operated power plants in connection with other reclamation projects. It is true that the government has built some fifteen small power plants in connection with irrigation projects. The total cost of these plants is slightly more than \$1,400,000, and the average cost is less than \$100,000. In other words, the argument is now made that because as an incident to the development of other irrigation projects the government has built some small power plants to furnish settlers on the irrigation projects with electricity—plants whose total capacity for the entire fifteen is less than 30,000 horsepower and whose total cost is approximately \$1,400,000—that the government has thereby established the precedent for going into the power business by building a dam and power plant primarily for power purposes, where flood control and irrigation are the by-products, this power project to cost at least \$100,000,000 and probably twice that, and to have a capacity of 1,000,000 horsepower. This single plant would have more than thirty times the total capacity of the other fifteen plants and the cost of it would be at least forty times the total cost of the other fifteen plants. Secretaries Weeks, Work and Wallace, in their letter commenting upon the Boulder Dam project, stated these facts as follows:

While the United States has heretofore constructed power developments in connection with irrigation projects, these developments have been merely incidental to the projects, have been of a few thousand horsepower only and have been primarily for use on the projects themselves. The construction of a reservoir having a capacity of some four to eight times the needs of

irrigation and flood control and of a power development twenty times in excess of the probable needs of the irrigated lands and adjacent communities is a complete departure from former policies.

This 1,000,000 horsepower hydro-electric plant would be several times larger than the Muscle Shoals plant. Aside from the Niagara Falls installation it would be the largest single hydro-electric development in the world. The power made available would exceed by 500,000,000 kilowatt hours annually the entire amount at present consumed in the only territory where this power could find even a partial market. This gigantic stride into the power business is to be made by the United States Government with money (more than \$100,000,000) raised from the taxpayers of the United States as a whole, under the specious plea that by the sale of power the money expended will eventually be repaid to the United States Treasury. And for what purpose is this huge investment and business experiment to be made? Why, say its proponents, in order to provide flood control and possible future irrigation needs in the Imperial Valley of California. In other words, in order to provide flood control and water for irrigation which, if those needs were taken care of, could be accomplished at a cost not exceeding \$15,000,000, it is proposed that the government invest an additional \$100,000,000 more and go into the power business in the hope that by this additional investment and over a period of fifty years or more the government will recapture all of its expenditure.

Two facts of the first importance have been insufficiently emphasized in all of the discussion of this project. These facts are, first, the size of the project and the relation between the expenditure for the legitimate function

of flood control as compared with the expenditure for the proposed new activity of the government in the power business; second, that a startling departure from former government policy is proposed, in that wherever it is possible to do so, the government may go into an entirely extraneous business unconnected with government functions, in order to attempt to repay the expenditure on the legitimate function; and that the government should do this regardless of the fact that the venture into business requires an expenditure of more than ten times the amount required if the government confined itself to its legitimate function.

Let us see where this departure from former government policies would lead us. Let us suppose that the government finds it necessary to build a storage warehouse for government property at a cost of a half million dollars, and located in some city in the United States; that local interests represent that there is need for another large department store in that city and urge that the government should not spend \$500,000 outright when by spending an additional \$10,000,000 the whole expenditure can be recovered. Popular clamor from that district for a huge government expenditure would be aroused, and we might expect all of the pressure that that community could muster would be exerted upon Congress to induce an appropriation of \$10,000,000 to build not only the warehouse but the department store. The precedent for such a measure would be very clear and well established if the Boulder Dam Bill were a law. Or again, let us suppose that the government is required to provide \$1,000,000 in storage tanks for the storage of oil from a government reserve, and that investigation discloses the possibility that an oil refinery in that district would be

acceptable. Again Congress would be importuned to provide \$20,000,000 with which to build an oil refinery and carry on that business, and the argument would be made, using the Boulder Dam Bill as a precedent, that it is very unwise for the government to make an outright expenditure when by coupling with that expenditure a large venture into the business world the taxpayer might be saved the million dollars which would otherwise be spent for oil storage. It is true that the oil industry might object and protest against the government entering its field of business, but would not their protests be drowned in the great flood of oratory about a great oil trust which was, through selfish motives, endeavoring to prevent the conferring by the Congress of this great boon upon the common people? I can hear them now, pointing out in eloquent terms the fact that oil is a great natural resource provided by God Almighty for the benefit of the people as a whole, and that no oil trust representing billions of invested capital shall be permitted to tell the Government of the United States that it cannot establish oil refineries for the benefit of all the people. And with the precedent of the Boulder Dam Bill before them, the Congressmen who might doubt the wisdom of the move would be hard-pressed to find an argument which could not be answered by that precedent. When the Congress of the United States commits itself to the proposition that in order to provide \$10,000,000 of flood control the government may go into business to the extent of \$125,000,000 to \$200,000,000, the barriers are down. In no state in the Union would any business be safe from government competition, handled by federal bureaucrats and financed by the United States Treasury, because in every state the government is

carrying on some function to which a huge business enterprise could be linked under the argument that the carrying on of the business was necessary in order to pay the expense of the government function.

I say, therefore, that if there was ever legislation proposed which challenged the rights of the states of the Union, we have such a proposal presented in this bill. It is not only the control of the federal government over the greatest river in the Southwest which is here proposed; it is an entering wedge for the removal from state control of large units in every great industry within our borders. This is no mere incident. The size of this proposal and the relation between the government-in-business feature and the legitimate government function is such that it must challenge the attention of every citizen who will for a moment give serious consideration to this aspect of it.

The right to tax and to regulate in the interests of our citizens those enterprises affected with a large public interest which are located within our borders is of the essence of state sovereignty. It is fundamental to the welfare of our citizens that the bodies which regulate their activities be located within the state's borders where complaints can be registered and heard without delay, where the conditions peculiar to the locality will be understood and where the regulating bodies are responsive to these conditions. Once the principle of control, ownership or regulation of local state industries by a federal bureaucracy is established by a measure such as the one under discussion, then we have saddled upon our people a new policy in government which will destroy the very foundation of the one we now enjoy. A new era in the struggle to maintain the sovereignty and rights of



our states is apparently upon us, and, unless we are alert, organized minorities with their eyes upon the fat purse of Uncle Sam, and their ears deaf to warnings, will barter away our birth-right.

#### THE PROPOSED LEGISLATION IS UN SOUND

This legislation is unsound in the legal justification for action by Congress and in the engineering and economic aspects.

The federal government has no right of authority over the Colorado River either as to the stream itself or the bed thereof, unless that authority can be found in the commerce clause of the United States Constitution. The federal government under the commerce clause has the right and power to make improvements upon a navigable river, and this authority can be exercised without regard to the consent of the states within the borders of which the river is located. The Colorado River is not now navigable in fact. In early pioneer days it was used for pioneer navigation. As has been pointed out by the government officials and engineers, this navigation has now been abandoned. Furthermore, there is no demand for its reinstatement. This legislation does not even purport to be for the purpose of improving navigation. On the contrary, the construction of the dam and the diversion of water as proposed in the bill would militate against navigation. The manifest and avowed purposes of the legislation are the development of power and the control of the river in the interests of irrigation and the prevention of floods. Assuming that an attempt were made to justify the erection of this dam and power plant under the commerce clause, it would be a clear case of an attempt on the part of Congress, under the pretext

of executing one power, to accomplish an object not entrusted to the federal government. In the case of *McCulloch vs. Maryland*, 4 Wheat. 316, 423, it was pointed out by Justice Marshall that any such attempt would be held unconstitutional. He said in that connection:

Should Congress, in the exercise of its power, adopt measures which are prohibited; or should Congress, under the pretext of executing its powers, pass laws for the accomplishments of objects not entrusted to the Government, it would become the painful duty of this tribunal, should a case requiring such a decision come before it, to say that such an act was not the law of the land.

The contention that Congress has the right to authorize this project on the theory that it has a duty to legislate for the reclamation of arid lands, or for the benefit of lands owned by the United States below the proposed structure, is not tenable. The Supreme Court has already definitely pronounced against any such authority. In the case of *Kansas vs. Colorado*, 206 U. S. 46, 51 L. Ed. 956, the Bureau of Reclamation made this contention, as stated by Justice Brewer in the following language:

It rests its petition of intervention upon its alleged duty of legislating for the reclamation of arid lands; alleges that in or near the Arkansas River, as it runs through Kansas and Colorado, are large tracts of those lands; that the national government is itself the owner of many thousands of acres; that it has the right to make such legislative provision as, in its judgment, is needful for the reclamation of all these arid lands, and, for that purpose, to appropriate the accessible waters.

After pointing out that the Government of the United States was a government of enumerated powers, and that only the powers actually granted

in the Constitution could be exercised by Congress, the contention so made was denied. There was also considered in that case another argument, which is sometimes made in behalf of this bill: that since there is no other adequate power to carry out this improvement that the United States should undertake it. In connection with that point the Supreme Court said:

But, as our national territory has been enlarged, we have within our borders extensive tracts of arid lands which ought to be reclaimed, and it may well be that no power is adequate for their reclamation other than that of the national government. But, if no such power has been granted, none can be exercised.

And finally in that case the court said:

But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that each state has full jurisdiction over the lands within

its borders, including the beds of streams and other waters.

A long list of cases theretofore decided by the Supreme Court is cited in support of the last statement.

In the light of this and other decisions of the United States Supreme Court the only sound conclusion which can be reached is that there is no legal basis for the proposed action by Congress. If the states within whose borders this river flows do not consent to its control by Congress, and do not consent to the construction of this structure which would give that control, then Congress has no authority whatever to authorize the Secretary of the Interior, or any other agent of the federal government, to undertake its construction. If, therefore, Congress should pass this bill, it would be doing a futile thing, and would be merely contributing to delay in the development of the river which it purports to be undertaking.

# The Company Point of View Regarding Boulder Dam

By C. WELLINGTON KOINER

District Manager, Southern California Edison Company

**T**HERE has been considerable discussion concerning the company point of view, that is, the attitude taken by the electric utility companies, particularly in Southern California, regarding the building of the Boulder Dam on the Colorado River.

The company point of view regarding the Colorado River development, or the building of the Boulder Dam, is briefly and tersely set forth in the following statement of Mr. John B. Miller, President of the Southern California Edison Company, in his financial statement of October 31, 1926, to the 105,000 stockholders of the company at that time. It sets forth the position of the company direct to its stockholders, and therefore cannot be construed as propaganda or intended for anything but the presentation of the facts of the company's position to the stockholders of the company, and therefore any amount of elaboration by additional words, or reference to the project could not set forth the point of view of the company more plainly, or directly, than that of Mr. Miller, whose statement is quoted herewith, verbatim.

## MR. MILLER'S STATEMENT

"We would like to see it cease to be made a football to be kicked around in the working out of petty political plans. The political plans are too infinitesimally unimportant—the quality of the electric service too vital. Why jeopardize the one with the other?"

These words, from the *Wichita Democrat*, refer to a situation in Kansas, but they are equally significant when applied to the Colorado River.

The Boulder Dam proposal for the use of government funds has reached such a stage as to make it seem possible that Congress may make the necessary appropriation to put the program through, as no other program carries such a great weight of political support.

As far back as 1921 I said, "If it is possible for the Secretary of the Interior to secure from Congress an appropriation sufficient to erect a dam on the Colorado River, which will equate the stream, remove the menace from flood and establish the necessary water for irrigation, I believe it would greatly facilitate the whole development."

I reaffirm this statement. Whether the government proceeds under the Boulder plan, or under a better plan, I have always advocated that the power be made available, by a general co-operative plan, to all distributing agencies in the Southwest both corporate and municipal, in proportion to their present and prospective power demands.

However, the Swing-Johnson Bill in its present form includes the unnecessary feature of government financing and construction of powerhouses as well as a dam, thus injecting the government into the power business.

Neither the government nor its tenants would be subject to regulation by the Federal Power Commission. The Congress of the United States, in the year 1920, after more than ten years of deliberation, created this Commission and adopted a statute controlling the development of water power upon public lands. This was, in fact, a declaration by Congress of the national policy regarding development of water power in the country.

The principal objection to the pending bill has centered around this feature and it is believed, therefore, that the bill will be amended—as has been recommended by Secretary Herbert Hoover—to remove this objection. Such an amendment would not interfere with any of the benefits sought nor with the repayment of the cost of the dam to the government. The bill in its amended form would provide that the government construct the

dam and that power development be made under the provisions of the national law and be subject to regulation by the Federal Power Commission. Any agency—municipal or corporate—desiring to develop power at the dam would have the opportunity to apply to the Federal Power Commission for a license so to do.

"Steam shovels and not politics will build Boulder Dam," says Mr. Hoover.



# Federal Water Rights in the Colorado River

By OTTAMAR HAMELE

Former Chief Counsel, United States Reclamation Service

IT is a common saying of the arid West that no irrigator is so honest that he will not steal water in an emergency. Like most epigrams, this saying is not strictly true, but it emphasizes in a colorful way the high value placed upon that compound of hydrogen and oxygen, known to chemistry as  $H_2O$ , in the great desert regions of Uncle Sam's far-flung sunset domain. It also explains in a measure the many bitter quarrels, both between individuals and between sovereign states, carried on for years over claims to the use of the insufficient discharge of Western streams.

Notable among such conflicts between the states were the long fight by Kansas and Colorado relative to the waters of the Arkansas (*Kansas v. Colorado*, 206 U. S. 46), and the equally earnest contest between Wyoming and the Centennial State concerning the Laramie (*Wyoming v. Colorado*, 259 U. S. 419; 260 U. S. 1). Each of these battles was waged in the United States Supreme Court and was carried no further only for want of a higher appellate tribunal. In neither instance was either contender satisfied with the result.

By the Colorado River Compact, drafted in 1922 under the able guidance of Hon. Herbert Hoover, it was planned to eliminate some of the water controversy on the American Nile, through an agreement between seven states and the Federal Government, allocating rights to the use of the flow of that turbulent stream. However, after more than five years of heated

discussion the proposed compact remains unratified.

## THE WAR OF WESTERN WATER

This continuous War of Western Water is waged not only on the irrigation ditch, before the court, around the conference table, and through the channels of publicity, but also in the legislative hall. One of its major engagements is now being fought out in Congress over the proposal that the United States construct at Boulder Canyon on the Colorado, a great reservoir, for the fourfold purpose of controlling floods, irrigating lands, providing municipal water, and developing a huge block of electrical energy.

The enactment of the Swing-Johnson bill authorizing the building of the Boulder Canyon project probably would be followed by litigation. United States Senator Carl Hayden, speaking for the state of Arizona, has given notice that if the bill is passed Arizona will be compelled in self-defense to file a suit in the Supreme Court to restrain construction until the rights of that state in and to the Colorado River are determined. (*Congressional Digest*, February, 1927, p. 50.)

The silt-laden waters of this great stream are clearly not of the healing variety, and prospects for peace along its 1700 winding miles appear to be somewhat remote.

Any discussion of water rights on the Colorado River prepared for the consideration of the general reader, should be prefaced by a brief explana-

tion of the doctrine of prior appropriation which obtains under local law in all of the seven States touched by the basin of that river. These seven states are Wyoming, Colorado, Utah, Nevada, New Mexico, Arizona and California.

The riparian water law of the humid East has been abrogated in each of these states, except California, where both riparian and appropriation rights are recognized. Under the doctrine of prior appropriation, he who first applies water to beneficial use either upon riparian or nonriparian land, acquires a vested property right to such use superior to the claims of all subsequent users. Such rights are recognized in the order of initiation until all of the water of the stream, if unnavigable, is utilized, and may be enforced without reference to State lines. (*Wyoming v. Colorado, supra.*)

#### THE POSITION OF THE FEDERAL GOVERNMENT

What may be called the official position of the Federal Government relative to the ownership of unappropriated water flowing in the unnavigable streams of the arid west, including the Colorado River, is stated on page 39 of the Annual Report of the Attorney General, dated December 7, 1914, as follows:

The department takes the position that in the arid and semiarid regions, where the legality of diverting and appropriating water for beneficial uses on nonriparian lands is generally established, the original right of the Government to appropriate surplus water for its own uses, particularly for the reclamation of its enormous holdings of arid lands, has not been surrendered by any act of Congress or divested by the mere creation of states into which those regions have now become incorporated.

This claim of the United States was briefed and argued in the case of

*Wyoming v. Colorado, supra*, first by Solicitor General John W. Davis, and later by Solicitor General James M. Beck, but the point was not passed upon in that case.

With unimportant exceptions, the territory lying in the Colorado River basin was acquired by the United States from Mexico under the treaty of Guadalupe Hidalgo of February 2, 1848, 9 Stat. 928. By that convention the United States became the exclusive and absolute owner, both as a sovereign and as a proprietor, of all of said watershed, the right as a proprietor being subject only to vested individual rights and such Indian rights as might be recognized. This ownership necessarily included both the land and the water.

Article IV, Section 3, of the Constitution provides that—

The Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States.

This power to dispose of the public domain is defined by the Supreme Court in *Gibson v. Choteau*, 13 Wall. 92, 99, as follows:

With respect to the public domain, the Constitution vests in Congress the power of disposition and of making all needful rules and regulations. That power is subject to no limitations. Congress has the absolute right to prescribe the times, the conditions and the mode of transferring this property or any part of it and to designate the persons to whom the transfer shall be made. No state legislation can interfere with this right or embarrass its exercise.

The public waters were a part of the public domain, were property of the United States within the meaning of the Constitution, and could be disposed of apart from the land. There are many decisions to that effect.

In *Cruse v. McCauley*, 96 Fed. 369, 373, the court states that—

As the United States owns the waters which are incidental to its lands, it can dispose of them separate from its lands if it chooses.

The Supreme Court of Oregon, in *Hough v. Porter*, 51 Ore. 318, says:

The water flowing over the public domain is a part thereof, and the general government may grant or otherwise dispose of its riparian interests separate from the rest of the estate.

The following language is used in *Howell v. Johnson*, 89 Fed. 556, 558:

Being the owner of these lands it (the United States) has the power to sell or dispose of any interests therein, or any part thereof. The water in an innavigable stream flowing over the public domain is a part thereof, and the National Government can sell or grant the same, or the use thereof, separate from the rest of the estate under such conditions as may seem to it proper.

It thus appears that the United States at one time had an ownership in the public waters of the Colorado River Basin, and that these waters were susceptible of disposition independently of the land in the same area. The question then arises: Has the Government transferred its rights in these waters?

#### THE GRANT OF FEDERAL WATERS

A search of the Acts of Congress will disclose but a single grant, which is contained in the Act of July 26, 1866, 14 Stat. 251, as supplemented by the Act of July 9, 1870, 16 Stat. 217. This grant was carried into the Revised Statutes as Sections 2339 and 2340, and later into Title 43, Section 661, of the United States Code, reading as follows:

Section 661. *Appropriation of waters on public lands; right of way for canals and*

*ditches.*—Whenever, by priority of possession, rights to the use of water for mining, agriculture, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed; but whenever any person, in the construction of any ditch or canal, injures or damages the possession of any settler on the public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage.

All patents granted, or preemption or homesteads allowed, shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water rights, as may have been acquired under or recognized by this section. (R. S. Sections 2339, 2340.)

This grant was made primarily for the purpose of protecting the investments made by early settlers in California, who, without authority, had appropriated and used land and water belonging to the United States, under local customs, laws, rules, and regulations. It has been held to be prospective in operation. (*Union M. & M. Co. v. Ferris*, 2 Sawy. 176, 24 Fed. Cas. No. 14,371.) The effect of this legislation clearly is that of a direct grant by the United States to the user of water where the latter is complying with the local laws, customs and statutes of the state within which the claim is made. The grant is limited to users of water; it does not run to a State or any other political body.

This grant has been somewhat amplified in the public land laws relating to the acquisition of water rights by individual appropriators, notably in the Desert Land Act of March 3, 1877, 19 Stat. 377, and in the National

Irrigation Act of June 17, 1902, § 32 Stat. 388. But again, all of this legislation relates alone to rights acquired by the application of water to beneficial use. There has been no blanket transfer out of the Federal Government.

#### THE DESERT LAND ACT

It has been argued that the Desert Land Act, just referred to, made a "dedication" of Federal water to the states. The pertinent provision reads as follows:

That the right to the use of water by the person so conducting the same, on or to any tract of desert land of six hundred and forty acres shall depend upon bona fide prior appropriation; and such right shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation; and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers, and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining, and manufacturing purposes subject to existing rights.

A brief examination of the quoted provision will show that it contains no grant to the states. They are not mentioned as would be the case if they were grantees. The act deals with individual appropriators as did the acts of 1866 and 1870. Congress lays down certain requirements of a water right, and speaks as would an owner regulating his own property.

A general transfer of Government property cannot be implied. A statute cannot be construed to affect any right of the United States in the absence of express language so providing. (*U. S. v. Oregon Co.*, 186 Fed. 861, 893; *Oregon R. R. v. Oregon Ry.*, 130 U. S. 1, 26; *Coosan v. State*, 144 U. S. 550.)

Also, it has been urged that Federal

grants of land have included a transfer of Federal water. The answer to this claim is that under the law of prior appropriation a grant of land from the Federal Government does not carry riparian rights. (*Coffin v. Left Hand Ditch Co.*, 6 Colo. 443; *Clark v. Ashley*, 34 Colo. 285.)

Again, it is argued that the admission of a state into the Union, under a constitution declaring water to be the property of the public subject to appropriation through state laws, constitutes a grant to the state of Federal water.

As has been shown, Congress alone has the power to dispose of public land and water, and a state constitution, even when supervised and ratified by Congress, is not an act of Congress. (*Coyle v. Smith*, 221 U. S. 559, 568; *Ex parte Webb*, 225 U. S. 663, 690.)

The Federal Constitution is a grant of powers, but state constitutions are limitations on power, not grants. The Supreme Court of Colorado, in *Packer v. People*, 8 Colo. 364, quotes with approval from Cooley on *Constitutional Limitations*, as to the nature of a state constitution, as follows:

It is not the beginning of a community nor the origin of private rights. It is not the fountain of law nor the incipient state of Government. . . . It grants no rights to the people; but it is the creature of their power, the instrument of their convenience.

#### THE NATIONAL IRRIGATION ACT

It is further contended that Section 8 of the National Irrigation Act is a surrender of Federal water rights to the states. This section reads as follows:

That nothing in this act shall be construed as affecting or intended to affect or to affect or to in any way interfere with the laws of any state or territory relating to the control, appropriation, use, or distribution of water used in irrigation, or



any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this act, shall proceed in conformity with such laws, and nothing herein shall in any way affect any right of any state or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof: *Provided*, That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right.

The first clause of the quoted section is merely a restatement of the general policy of the Government as it appears in the acts of 1866 and 1870.

The second clause, to the effect that the Secretary of the Interior in carrying out the National Irrigation Act, is to proceed in conformity with state laws, is the usual Federal "conformity" provision, such as is found in the statutes concerning condemnation—a conformity with the laws of the state in so far as those laws do not interfere with the rights of the United States. It is significant that there is no provision in the National Irrigation Act requiring the Government to "appropriate" any water. The Secretary of the Interior is authorized by Sections 4 and 5 to sell the Government's water and by Section 7 to buy or condemn water rights, but nowhere in the act is it suggested that it is necessary for the United States to make an "appropriation."

The quoted section also provides that "nothing herein (in Section 8) shall in any way affect any right . . . of the Federal Government . . . in, to, or from any interstate stream or the waters thereof." The Colorado River is an interstate stream and therefore no right of the Federal Government therein held at the time of the passage of the National Irrigation Act in 1902 was affected by the section quoted.

This section further requires that the water rights acquired by individuals thereunder shall be appurtenant to the lands irrigated. This is a declaration of Government ownership and control of its waters, as this provision is contrary to the water law of several Western states, providing that water rights are not appurtenant to the land irrigated.

The point under consideration is admirably summed up by Mr. Kinney, one of the leading authorities on Western water law, as follows:

Our conclusions upon this subject are, that the United States, as the original owner of all of the land on the public domain, was also the owner of all the waters of the natural streams and other bodies flowing thereon. By various Acts of Congress the United States has disposed of some of these waters under the Arid Region Doctrine of appropriation; and that the United States is still the owner of these waters, which have not been disposed of, regardless of the action of the state or territory wherein they are located. The right to the use of other of its waters has also vested in the individuals who have from time to time acquired tracts of lands from the Government bordering upon the streams, as a riparian right, in those states where those rights are permitted. It was left to the various states, as a matter of sovereignty or jurisdiction to prescribe how the title to the use of the waters might be acquired by individuals, in accordance with its local customs, laws, and decisions of the courts. When the local customs, laws, and decisions of the courts had been fully complied with by an individual seeking to acquire a water right the title to the same vested in the individual direct from the United States, and not from any state. 2 Kinney, Irrigation. (2d. ed.) Sec. 640.

From the foregoing it seems quite clear that the United States is still the owner of the unappropriated waters of the Colorado River, and may utilize them for public purposes without the consent or approval of

any of the seven states touched by the watershed of that stream.

#### SPECIAL AUTHORITY FOR CONSTRUCTION OF BOULDER DAM

As to the proposed Boulder Canyon development, there is a special reason why the state of Arizona, which is one of the principal objectors thereto, is not in a legal position to interfere with the same. That state entered the Union under an enabling act which expressly retained in the Federal Government the right to carry on operations of this character. The pertinent provisions of the law (Act of June 20, 1910, 36 Stat. 557, 570, 574, 575) are as follows:

That there be and are reserved to the United States, with full acquiescence of the state (Arizona) all rights and powers for the carrying out of the provisions by the United States of the act of Congress entitled "An Act appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands," approved June seventeenth, nineteen hundred and two, and acts amendatory thereof or supplementary thereto, to the same extent as if said State had remained a Territory.

. . . no lands (in Arizona) which are or shall be susceptible of irrigation under any projects now or hereafter completed or adopted by the United States under legislation for the reclamation of lands, or under any other project for the reclamation of lands, shall be sold at less than twenty-five dollars per acre: *Provided*, That said state, at the request of the Secretary of the Interior, shall from time to time relinquish such of its lands to the United States as at any time are needed for irrigation works in connection with any such Government project; and other lands in lieu thereof are hereby granted to said state, to be selected from lands of the character named and in the manner prescribed in section eleven of this act.

There is hereby reserved to the United States and exempted from the operation of any and all grants made or confirmed by this act to said proposed state all land actually or prospectively valuable for the development of water powers or power for hydroelectric use or transmission and which shall be ascertained and designated by the Secretary of the Interior within five years after the proclamation of the President declaring the admission of the state; and no lands so reserved and excepted shall be subject to any disposition whatsoever by said state, and any conveyance or transfer of such land by said state or any officer thereof shall be absolutely null and void within the period above named; and in lieu of the land so reserved to the United States and excepted from the operation of any of said grants there be, and is hereby, granted to the proposed state an equal quantity of land to be selected from land of the character named and in the manner prescribed in section eleven of this act.

Attention is particularly directed to that clause which reserves to the United States all rights and powers for carrying out the provisions of the National Irrigation Act of June 17, 1902, under which the Boulder Canyon dam would be constructed, "to the same extent as if said state had remained a territory." Before statehood Congress has plenary power over a territory unlimited even by the restrictions of the Constitution. The right of Congress to reserve Federal waters cannot be denied. (*Winters v. United States*, 207 U. S. 564.) Congress may even annul an act of a territorial legislature or legislate direct for the local government. (*Brunswick First National Bank v. Yankton Co.*, 101 U. S. 129; *Baca v. Perez*, 8 N. M. 187, 42 Pac. 162.) Were Arizona still a territory no one would question the right of the United States to deal with the public land and water therein as Congress might direct. It seems to follow that because of the

reservations in the enabling act no one can successfully question it now. And it should be added that an Arizona appropriation of water, good in that state, is also good throughout the entire stream system. (*Wyoming v. Colorado, supra.*)

A full recognition of the rights of the Federal Government to the unappropriated water of the Colorado River, would lead to most admirable results. Because of the interstate character of this stream, a general control outside of the seven interested states is peculiarly desirable. The United States has no interest adverse to any state, and should be able to do justice to all. Through such a control, much long, expensive and unsatisfactory litigation, such as that

involved in the eleven-year quarrel between Wyoming and Colorado, heretofore referred to, could be avoided. Questions as to conflicting rights could be quickly and finally settled, with a view to protecting all interests of the basin, rather than those of a single state.

It is indeed to be regretted that a wise and understanding statesmanship did not definitely settle this question as to each state by clear, explicit provisions in an enabling act. That was done fairly well as to public land; it should have been done as to public water. Then a truly constructive result would have been achieved and the casualties in the War of Western Water would have been materially reduced.

# The Boulder Canyon Project

By HON. HIRAM W. JOHNSON

United States Senator, California

**T**HE Boulder Canyon project, now before the Congress of the United States in the Swing-Johnson bill, is without a doubt the greatest constructive project pending before Congress at this time, and indeed, the greatest constructive project of our generation. There is nothing comparable to it within our memories, save the construction of the Panama Canal. It is a project of national importance, not only because of its importance for the control of floods, the reclamation of land, the conserving of water for domestic use, but also because the great private power interests have elected to make this bill the focal point in the struggle to retain in private monopoly the development of power. Here will be developed electric energy in the amount of 550,000 firm horse power which the bill provides shall be available for all the people. But the gigantic power combine is determined that this power shall be for their monopoly alone and this is the real issue upon which the opposition to the Swing-Johnson bill is based.

The Swing-Johnson bill for the development of the Colorado River is the result of years of labor and research on the part of the best engineering minds of the country to produce a workable plan, just and fair to all interests and sections. It provides, first, flood control and river regulation; secondly, reclamation of a million or more acres now waste; thirdly, domestic water for the coastal cities of the southwest; fourthly, an all-American canal to the Imperial Valley upon American soil, solving the present intolerable inter-

national situation; and lastly, as a by-product of the plan, the generation of power, which will enable the project to pay for itself.

## THE SWING-JOHNSON BILL

The Swing-Johnson bill provides for the building of a dam at Boulder or Black Canyon on the boundary of Arizona and Nevada. It proposes at that point to erect a dam 550 feet in height—the highest dam that now exists in the world—in order to store there by virtue of that dam 26,000,000 acre feet of water, creating a lake that will extend back almost one hundred miles from the dam, thus regulating the flow of the river, thus controlling its floods, and making the Colorado River, the third largest in the United States, a servant to mankind and a servant to the territory through which it flows.

The estimated cost of the project, as given by the Secretary of the Interior in his report of January 12, 1926, recommending the authorization of this project, is \$104,000,000. This estimate is not mere guesswork but the result of long and painstaking studies by the Interior Department, and consultation with some of the leading engineers of the nation in addition to those of the Reclamation Service. The figures compiled have in turn been carefully checked and rechecked by the engineers and experts of the Imperial Irrigation District and others interested in the project. The same engineers have also estimated that sale of power and the returns from water storage will return a gross annual revenue of \$12,-



\$300,000, or a net annual surplus of \$6,100,000, or sufficient to repay the entire cost of the project with interest in twenty-five years.

The Swing-Johnson bill provides that no work shall be begun on the project nor any action be taken in regard to any water rights until the states interested, or at least six of them, have approved the Colorado River compact. The states having an interest in the Colorado River development are Wyoming, Colorado, Utah, and New Mexico, the so-called Upper Basin States, and Arizona, Nevada and California, the Lower Basin States.

The Colorado River compact is a compact for the settlement of water rights on the Colorado River by interstate agreement and was signed by representatives of the seven states on November 24, 1922. All of the states except Arizona ratified the compact at that time. Later, in 1925, a six-state ratification of the compact was suggested, and this was approved by the four Upper Basin States and Nevada. California approved the compact under the six state plan with her approval to become effective when legislation was enacted which would provide for a high storage dam at Boulder Canyon. Such storage would conserve and make available for use in the states below the vast quantities of flood waters which now waste to the sea. Without this protection California felt that her rights to the water required for her needs would not be safeguarded. Although the Swing-Johnson bill safeguards in every way the rights of the Upper Basin States to their share of the water, Utah during the last session of Congress withdrew her ratification of the compact. Arizona has consistently refused to ratify any compact, basing her refusal on various pretexts, but the most evident

reason is the desire of the state of Arizona to secure a revenue from any development of the Colorado River, either in the form of taxation of the works or a royalty on any power generated. There is no quarrel with Arizona on the part of California in regard to the division of the water and many conferences between the commissioners of the two states have indicated that California is willing to go more than half way in giving Arizona a large share of the water of the river. During the last fall conferences of representatives of all of the states were held at Denver in an endeavor to reach an agreement for the distribution of water and power which would be agreeable to all states interested in the Colorado River development. No definite agreement was reached and the conference only served to make it more evident that this project is bigger than an inter-state project. It is a national project in which the Federal Government has a deep interest and it must be constructed and its product of water and power distributed under federal supervision. The Denver conferences have only emphasized this fact. This in brief is the Boulder Dam project and what the Swing-Johnson bill proposes to do in making it a reality.

#### THE SERVICE OF BOULDER DAM

The problem of flood control and river regulation is a pressing one and one whose early solution is necessary if the fertile valleys of the Imperial and Yuma are to be preserved. The Imperial Valley lies in the southeasterly portion of California. On the south it is bounded by the Mexican line. Its easterly edge is about forty miles west of the Colorado River. Centuries ago the Imperial Valley was the northerly end of the Gulf of California. The tremendous quantities of silt carried by the river gradually built a huge delta

or dam across the gulf completely cutting off the northern end. Evaporation gradually dried up this section and left, lying in the form of a huge bowl, what is now the Imperial Valley. Around the rim of this bowl from 100 to 350 feet above the cultivated and settled areas runs the Colorado River. The river is building up its channel higher and higher through the deposit of more than 100,000 acre feet of silt carried down by its sediment loaded waters annually. This means that levees must be raised higher and higher with greater costs and with increasing danger of failure. A break will mean the loss of all that has been built up in thirty years by the men and women who have reclaimed this region from the desert. Experts are agreed that, unless the floods are controlled and the silt eliminated, it is only a matter of a few years until levees will no longer hold the Colorado in its present channel; when the inevitable break will come and the waters turned into the Imperial Valley. Since the Valley has no outlet this means permanent inundation and destruction for all time of the millions of dollars in property as well as probable loss of human life. The Boulder Dam will forever end the flood menace of the lower river. The huge reservoir will catch and hold the flood waters until they can be released gradually at a rate the river channel can accommodate with safety. Silt now deposited in the lower reaches of the river, aggravating and to a large extent causing the flood danger, will be intercepted and held at the reservoir.

With the danger of flood removed and a regulated flow of the stream assured, but one more thing would be needed to assure the Imperial Valley of an adequate supply of irrigation water and continued development. That need is the all-American canal,

provided by the Swing-Johnson bill. The present main canal which supplies the irrigation and domestic water for the Imperial Valley runs for sixty miles through Mexican territory. This canal is under the control of a Mexican corporation, subsidiary to the Imperial District, and subject to a contract with the Mexican government that gives to the landowners on the Mexican side of the boundary, one-half of the water flowing in the canal. As irrigation uses have increased in Mexico the water available for irrigation in the Valley during the period of the low flow of the river has grown less and less, as the Valley gets what water is left after the Mexican users have supplied their needs.

The building of the all-American canal as provided by the Swing-Johnson bill will put an end to the intolerable situation which now exists with the Imperial Valley water supply under Mexican control. The seriousness of the situation may be realized by the fact that, if the supply of water delivered by this canal were interfered with for only a period of a few days, Imperial Valley would not only be faced with financial ruin from the destruction of all crops but the people themselves would have to move from the Valley as no other source of water is available even for drinking purposes. If there were any difficulty with Mexico, the Mexicans could take possession of the present canal which is the jugular vein of the Imperial Valley. With one stick of dynamite one hundred million dollars worth of property and the homes of happiness of sixty thousand or more people could be destroyed.

Another important feature of the all-American canal is that it will assure the landowners of the Imperial Valley an abundant water supply at all times which will enable them to develop their

land to the fullest advantage. This they cannot do at present because of the first call on the water by the owners of lands in Mexico. This land owned by American capitalists is being cultivated with Oriental and other foreign labor in direct competition with the citizens of the United States on United States territory. These owners of Mexican land claim the right to receive water through the Imperial canal sufficient to irrigate an acreage in Mexico equal to that irrigated through that canal in the United States. The unregulated flow of the Colorado River will supply water for only about 600,000 acres, and there are now under cultivation 400,000 acres in the United States and 200,000 acres in Mexico. Hence, for every additional acre that is hereafter placed under cultivation in Mexico, an acre of land now under cultivation in the United States must return to the desert. With the Mexican acreage under cultivation showing a yearly increase, it can easily be seen that the situation is becoming more intolerable all the time.

Some objection has been voiced to this development that it will bring more land under cultivation in competition with lands now being cultivated in other parts of the nation, especially with the cotton growers of the South. The competition in cotton growing comes almost entirely from the Mexican side of the border. Long since the Imperial Valley farmers found they could secure much greater returns from diversified vegetable and fruit crops than from cotton, but on the Mexican side, with cheap labor, cotton is the crop on about ninety per cent of the land under cultivation. Continuance of the present condition, or the building of a purely storage dam without the all-American canal, will mean that the Mexican landowners will be among the greatest beneficiaries

from the use of the waters of the Colorado and they will steadily increase their acreage in competition with staple American products such as cotton.

The all-American canal will be at sufficient elevation to carry water to additional land, mostly public, lying along the rim of the Imperial Valley and in the Coachella Valley. The Imperial Valley might well be called "America's hothouse," and from it are supplied to the nation at off season vegetables and small fruits of all kinds, none of which come in direct competition with any other community. Dates and other tropical fruits not grown elsewhere in the United States are also products of this rich section. For this reason any new land brought under cultivation by the all-American canal or by the development of the Colorado River will produce these same crops and add nothing to the farm problems of the nation.

The Swing-Johnson bill provides that all lands practicable of irrigation and reclamation by the irrigation works authorized shall be withdrawn from entry, and when the works are sufficiently constructed to permit the delivery of water the same shall be open to entry in tracts not exceeding 160 acres, with preferential right to persons who have served in the United States Army, Navy or Marine Corps. There are 166,900 acres known to be irrigable from the all-American canal which will be subject to such entry. In addition there will be considerable land in Arizona which will benefit by the increased water supply.

The construction of the high dam at Boulder Canyon will, incidentally, enable the cities of southern California, now threatened with a water shortage due to rapidly increasing population, to secure additional water supply for the domestic use of their inhabitants. The present sources of supply have

been exhausted and the Colorado River is the only available source for the present population of the southern California coastal belt of approximately two million. About 1500 second feet of water will be required to supply this need. The cities interested, headed by Los Angeles, have taken steps to form a metropolitan water district to handle the building of an aqueduct two hundred and sixty miles long from the Colorado River and to provide for the distribution of the water. They are prepared to spend \$150,000,000 for this purpose and have already spent a considerable amount in preliminary work. The large storage proposed at Boulder Dam will impound the flood waters that now go to waste and provide an excess over irrigation needs sufficient to supply these requirements for domestic use. The storage of this water and its delivery to the cities will provide a revenue to the government from the project. The fact that it will be necessary to pump the water over a mountain range to southern California will also provide a market for much of the power generated at the dam.

#### OPPOSITION OF THE POWER MONOPOLY

We have here then the purposes to which the Swing-Johnson bill is dedicated and what will be accomplished by the completion of the Boulder Dam project—flood control and river regulation, reclamation of lands and the emancipation of American land from Mexican control by the building of the all-American canal, and providing domestic water for the cities of southern California. Surely there is nothing in this beneficial program to arouse the nation-wide opposition to the Boulder Dam project that is now making its appearance at every convention of a national character. But the Swing-Johnson bill, at the behest of the Secretary of the Interior, provides

that the Secretary of the Interior be authorized in his discretion to construct power plants as part of the project and to sell power wholesale at the switchboard to municipal corporations, political subdivisions and private corporations. Or he may lease the water at the dam to various applicants for the generation of power. This is for the protection of the government in the financing of the dam; a guarantee that the government will be repaid for its cost.

For years the private power companies have had visions of the potential value of the Colorado River as a source of electric energy. They also saw the cities of the California southern coastal belt increasing in population and in industries, with ever increasing demand for power, and their plans for the future included an absolute monopoly of the power resources of the Colorado River. Then came the Boulder Dam project with its provision that the people themselves as represented by their municipalities or their irrigation districts would have the right to buy power direct from the switchboard at the dam or to build generating plants of their own using the stored water.

The rights of the people to secure the fruits of this great national resource did not enter into the plans of the power combine and there has now been mobilized to prevent it one of the most powerful lobbies that has ever been assembled at Washington. Over the nation is being spread a mighty flood of misleading and false propaganda against the Boulder Dam project. Every source of propaganda that is conceivable today is in operation against this monumental work. Every single kind of publication that can be utilized against the building of this dam is now utilized in every part of the United States. Under the name of the



Joint Committee of the National Utility Association of 420 Lexington Avenue, New York, representing, as one of its officials boasted during last session of Congress "an investment of \$7,000,000,000 which does not propose to permit the Government to enter the power business at Boulder Dam," the power combine is making its battle against this project.

#### THE ACTUAL PROVISIONS AS TO POWER

What are the facts about the power provision of this bill? The facts are all in the record of the hearings before the committees of Congress. When the bill was before the committee on Irrigation and Reclamation in the Senate, as was usual, it was transmitted to the Secretary of the Interior, under whose jurisdiction it comes, for his comment, his amendments and his approval or disapproval. When the bill was thus submitted to the National Administration, it contained no provision for the construction, either optional or otherwise, by the Government, of a plant for generating electricity. On the 10th day of January, 1926, the Secretary of the Interior reported upon the bill to the Senate Committee and in this report the Secretary expressed opposition to the allotting of power privileges, as proposed in the Senate bill, and advocated the building of a unified power plant by the Federal Government as more efficient and cheaper resulting in the elimination of controversies between applicants and long delays in their adjustment. In detail he gave his views as follows:

The building of a unified power plant by the Federal government in the place of allocating power privileges, as proposed in the bill, is regarded as more efficient and cheaper. It will obviate controversies between applicants and long delays in their adjustment. In the end, I believe, results

will be superior to those under an allocation of privileges. The area for the location of separate power sites is restricted. Allotments would not be equal in value. Some allottees would therefore have an advantage over others. It would result in the creation of operation and administration controversies to be avoided and which a unified development would avert.

Thereafter, in accordance with the direction of the Secretary of the Interior, representing the administration, the bill was amended so that a permission was given to the United States government hereafter, if it saw fit, to construct a generating plant at the dam. This provision was an option, a permission, a mere right if in the discretion of the Secretary it might seem wise thereafter to construct a generating plant. With this amendment the bill received the hearty approval of the Secretary of the Interior and the Secretary of Commerce and the endorsement of the President of the United States. The Secretary was entirely right in his views and none can question either the wisdom or necessity for the particular provision.

It prevents the monopolization of the power resources of the Colorado River. Such monopolization by any private agency would dominate the industrial and political life of the Southwest. With the government in control of the development, and the power made available allocated to various agencies, the danger of monopolization of the power of the Colorado River is forever effectively removed.

Out of the insertion of this provision in the bill at the request of the Secretary of the Interior for the full protection of the government in the financing of the project and that all who might benefit from the generation of power might have equal rights, has come the terrific opposition now directed against the Swing-Johnson bill; the marshall-

ing of billions and the calling to arms of every adherent of industrial monopoly and corporate control of utilities.

#### THE MENACE OF THE POWER LOBBY

The United States Government must have neither option hereafter nor permission to exercise a discretion in the greatest undertaking since the Panama Canal. The power trust says so and in advance vetoes legislation. It challenges not only independence of congressmen and senators but challenges the very government itself. It not only puts its profits above a people's welfare but says a people's government must do likewise.

They cry that the "government is going into business," that it is competing with private ownership and investments on an unfair basis.

This is not really an issue of government ownership at all. It involves no transmission of power by the government, leasing only either of power at the switchboard or water for the purpose, as the Secretary of the Interior in the exercise of a wise discretion may decide. The power companies are unwilling to trust the Secretary of the Interior and the present administration

and demand that no discretion shall be given them. They frankly say they fear the establishment of a precedent and that in relation to the last great natural resource of the nation, they will take no chances on its preservation for the people, but that it must be administered primarily for the hydroelectric power companies.

To accomplish their purpose they have gathered at Washington, representing the public utility organizations of the nation, this great lobby. They have the active aid of men like Samuel Insull, who controls the power utilities of the Middle West and who is charged with having gone so far as to purchase a United States senatorship on behalf of his monopoly. To all the stockholders of his companies has been sent a notice warning them of the dangers of the Boulder Dam project.

The situation is really the age-old struggle of those who hold that what God gives belongs to the people and those who hold that it belongs to the few. The issue has been made, and it must be met at this session of Congress by every self-respecting legislator, and by every man who believes that the government, dealing with its own, is superior to any private interest.

# Muscle Shoals, Nitrogen and Farm Fertilizers

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ONLY about twenty-five years ago, a warning was issued by Sir William Crookes that the world's supply of available nitrogen was running short and a method of fixing the uncombined nitrogen of the air should be devised if the world was not to suffer in its food supply. From that time much progress has been made until today serious consideration is being given as to the best methods of utilizing the nitrogen that is or may be made available. The use as fertilizer is believed to be the field for the largest consumption of nitrogen. No longer is there any doubt as to the possibility of fixing nitrogen; the problems now are connected largely with commercial development and with the utilization of the fixed nitrogen products, even though great improvements may be made in nitrogen fixation processes. In discussing the subject indicated by the title, it is therefore necessary to trace somewhat the development of the methods of fixing nitrogen and outline to some extent the changes that have come about since the question of Muscle Shoals was first presented and also the tendencies of the nitrogen fixation industry.

## NITROGEN IN NATURE

Nitrogen occurs in nature in largest amount as uncombined gas in the atmosphere, of which it constitutes about four-fifths by volume. It is also a constituent of mineral deposits, the principal one of which is the Chilean nitrate beds; it occurs in coal, in animal and vegetable residues and in

the living tissues. It is indispensable to animal and vegetable life, just as essential as carbon, hydrogen or oxygen. And yet neither animals nor plants can utilize directly the nitrogen of the atmosphere. There is a natural cycle which roughly may be indicated as free nitrogen entering into combination through the agency of bacteria or under the influence of electric discharges, these combinations entering the plant and being transferred from plant to animal and finally through bacterial agencies returning again to free nitrogen, or remaining in the soil in accumulations under certain conditions.

An element so essential in life processes, when applied in assimilable and suitable form to the soil results in greatly stimulating plant growth and thus becomes important as a fertilizer. An interesting estimate or what may be more accurately called a speculation, has been made concerning the annual losses of nitrogen by Dr. J. G. Lipman of the New Jersey Experiment Station. This loss of nitrogen from all land under cultivation in the United States is stated as between 3,000,000 and 4,000,000 tons, after due account is taken of the amount returned to the soil by manures, by leguminous crops, by atmospheric precipitation as rain or snow, and by the application of commercial fertilizers. This amount of nitrogen is equivalent to 15 to 20 million tons of ammonium sulphate or of nearly 200 million tons of ordinary mixed fertilizer. Part of this loss would occur under natural conditions, but

part of it is brought about through cultivation with resulting increase in leaching and more rapid oxidation of soil organic material. These losses may be decreased by the conservation of natural sources, or the employment of certain crops or rotations to increase the natural supply. The employment of better means of preventing soil erosion or leaching will add materially to the nitrogen conserved. The better use of green manures, and plant residues, the better conservation of animal manures, and the maintenance of soils in a condition suitable for the growth of nitrogen-fixing organisms will all contribute toward increasing the supply of nitrogen available. After all these resources have been utilized to the fullest extent, however, there will still remain a deficit of available nitrogen which must be met at some future time. There is no source capable of meeting the ultimate demand except the atmosphere. With most of the better agricultural lands already under cultivation, the world must in the future look to increased production to feed the increasing population of the world. There are many factors involved in bringing about increased production, but not the least of these is the application of commercial fertilizers.

There will probably be immediate objection to increasing the production of farm products, but this objection holds only at present as to total production. Increasing the yields per acre and making the labor more efficient is not objectionable, for it means cheaper production costs, and the release of labor for other useful work. And this is just what can be accomplished with the application of fertilizers. In general the farmer may raise with less labor and on less land the same amount of crop with the application of fertilizers that he does with more labor and on more

land without fertilizer; and the cost of the fertilizer does not by any means equal the increased value of his crop. There are exceptions to this, but as a general rule, the use of fertilizers on soils of humid regions is profitable.

#### SOURCE OF NITROGENOUS MATERIALS

It has just been stated that the only source of nitrogen capable of meeting the ultimate demand for agricultural purposes is the atmosphere, but in order to understand the situation we should give some attention to the other sources of nitrogen. The first and most important supply of nitrogen has been sodium nitrate derived almost exclusively from the Chilean deposits. This supply is already beginning to feel very keenly the competition of the fixed nitrogen from the air. While undoubtedly it will continue for a long time to be an important material, the decreasing production and use of Chilean nitrate has already begun.

The second source of importance is ammonium sulphate derived as a by-product from coke ovens and gas plants. With our present methods of manufacture of pig iron, it is most likely that the production of this material will not decrease. That there may not be the great increase anticipated in some quarters by the increasing demand for coke for domestic purposes is possible, but the commercial development of methods of producing liquid fuel from coal may ultimately increase the supply of ammonium sulphate. This industry can hardly be said to be in its infancy yet, but its development may so influence the fuel industry and incidentally the ammonium sulphate supply that its effects cannot be foretold at present.

In addition to these two larger sources of nitrogen, there are many smaller ones, mostly of organic materials, such as cottonseed meal, slaughter-



house tankage and waste products such as dried blood, fish scrap, garbage tankage and other minor materials. Much of these materials has been and is being lost to fertilizers and is going into feed stuffs because of their higher value in this field.

#### ATMOSPHERIC NITROGEN FIXATION PROCESSES

A survey of existing sources of materials aside from nitrogen fixation processes shows that the prospects of enormously increasing production is not likely and for the future the increased demand must be met from the atmospheric nitrogen. This has been recognized for nearly thirty years and investigations on methods of nitrogen fixation have been stimulated to meet the demand. The World War, however, furnished the greatest impetus to the development of the fixation industry.

The three types of processes that have attracted most attention in the development of the nitrogen fixation industry are known as the arc, cyanamide, and direct synthetic-ammonia processes. The first of these is based on the most obvious method of fixing nitrogen, that is bringing about the combination of the nitrogen and the oxygen of the air and absorbing the nitrogen oxides produced in water to form nitric acid. This combination is effected by the passage of an electric arc through the air. The energy consumed per unit of nitrogen fixed is very high and so the process is applicable only where power is very cheap. The second or cyanamide method, which employs coal, coke, limestone and nitrogen from the air to produce a solid substance carrying about 22 per cent nitrogen, also requires much power, but only about one-fourth the amount per unit of nitrogen of that required for the arc process. It is sufficiently high,

however, to demand comparatively cheap power for the successful operation of the process. The third or direct synthesis method, in which hydrogen and nitrogen combine under the influence of a catalyst to form ammonia, requires about one-fourth the power of the cyanamide process, and here a condition is reached where power is not so important a consideration in the process.

#### THE NITROGEN SITUATION AT THE BEGINNING OF THE WORLD WAR

The situation at the beginning of the World War was such that, while the world was familiar with the arc and the cyanamide processes for fixing nitrogen, Germany alone had developed the direct synthetic method on a commercial scale. The United States just before its entrance into the war realized that there should be some additional supplies of fixed nitrogen within the country. The demand for increased supplies was partially met by the increase in by-product ammonium sulphate from coke ovens. Even this was not sufficient, and in the National Defense Act of June 3, 1916, Congress made available for the President \$20,000,000 for an "investigation of various methods for the production of nitrate and other products for munitions of war and useful in the manufacture of fertilizers." Investigations of conditions in this country and abroad resulted in a recommendation that the War Department take over the process of the General Chemical Company. This process was a modified form of the direct synthetic Haber process as practiced in Germany, but it had not been tried out on a commercial scale. Something had to be done, however, and the War Department erected Plant No. 1 at Sheffield, Ala., to test out the process. Only one unit of the plant was ever completed

and difficulties encountered in operation showed that the process part of the plant would have to be remodeled.

Almost immediately after it had been decided to erect Plant No. 1, it was realized that an additional source of nitrogen should be provided for by a well understood and dependable method and a contract was entered into with the American Cyanamid Company to erect Plant No. 2 at Muscle Shoals, Ala., with an annual capacity of 40,000 tons of fixed nitrogen. The plant was completed and a successful test run made just a short time before the signing of the Armistice.

The wisdom of building Plant No. 2 can hardly be questioned as the cyanamide method was the only one on which the information available was sufficient for successful and undoubted operation. The method had been in operation at Niagara Falls, Canada, for several years and there was no doubt that it could be relied upon to fix nitrogen.

#### THE PRESENT NITROGEN SITUATION

Conditions since the close of the war, however, have changed greatly. Beginning in 1915 the study of the direct synthetic ammonia process at the Arlington Farm laboratory of the Bureau of Soils, the United States Department of Agriculture made its facilities available to the War Department in 1918. This earlier work was augmented with the establishment of the Fixed Nitrogen Research Laboratory. The development of catalysts and the acquiring of additional information on the process has been followed by the establishment in this country of a number of relatively small direct synthetic ammonia plants, but at least two companies, Lazote, Inc., and the Atmospheric Nitrogen Corporation have sufficient backing to develop the process on a large scale as occasion demands. The development of nitrogen

fixation in this country has been almost exclusively with the direct synthetic method. No cyanamide plant is operated in the United States; the plant at Niagara Falls is on the Canadian side. The arc process is operated at one location in the West where power is cheap.

The trend in this country is only indicative of the development of the direct synthetic process throughout the world. There has been a continuous increase in the amount of nitrogen products coming from the direct synthetic method. The world consumption of inorganic nitrogen for the year ending June 30, 1927 was 1,315,000 against 1,206,000 tons last year and 1,088,000 tons the year before. By-product ammonium sulphate supplied 310,000 tons against 300,000 last year and 275,000 the year before. Synthetic nitrogen in different forms supplied 734,000 tons against 583,000 tons last year, and 450,000 tons the year before. Consumption of Chilean nitrate was 271,000 tons of nitrogen against 323,000 tons last year and 363,000 tons the year before. This shows that the increase in nitrogen consumption is being met largely by nitrogen fixation processes. As an illustration of the rapid development of the direct synthetic process, there were in the world in 1913, seven arc plants of capacity of 19,800 tons of nitrogen per year, fifteen cyanamide plants of a capacity of 66,000 tons and one direct synthetic plant of 7,700 tons, while at the close of 1918, there were twelve arc plants of a capacity of 41,800 tons, thirty-five cyanamide plants of 357,500 tons capacity and three direct synthetic with 338,800 tons. There are in 1927, operating or building, seven arc plants of 46,200 tons, twenty-eight cyanamide plants of 313,500 tons and forty-nine plants for direct synthesis of 770,000 tons capacity.

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The trend of production of fixed nitrogen from the various sources may be seen from Table I, in which the total amount of nitrogen produced by atmospheric nitrogen fixation processes. The increasing relative importance of

TABLE I—WORLD PRODUCTION OF FIXED NITROGEN FROM VARIOUS SOURCES IN TONS

Sources	1913	1914	1920	1926
Chilean Nitrate.....	455,906	413,127	422,628	271,000
By-Product Ammonia.....	305,099	271,823	391,400	310,000
Cyanamide Process.....	35,838	44,035	130,000	174,000 <sup>1</sup>
Direct Synthetic Processes.....	6,798	13,596	297,000	519,450 <sup>2</sup>
Arc and Other Processes.....	19,800	23,000	42,130	40,550

<sup>1</sup> Total capacity of plants, 328,000 tons.

<sup>2</sup> Total capacity of plants, 724,000 tons.

world production for two years at the beginning of the World War and for 1920 and 1926 is shown. The production of Chilean nitrate shows a marked decrease for 1926, while that from direct synthetic methods is very greatly increased. The total estimated capacity of cyanamide plants in 1920 was about 325,000 tons, and for 1926 about 328,000 tons with a production in 1926 of 174,000 tons. Despite the difference between capacity and production of cyanamide plants, rapid construction of direct synthetic plants has taken place. The estimated capacity of these plants in 1920 was 311,000 tons, and in 1926 was 724,000 tons. The difference between capacity and production in these plants is mostly due to the construction of plants of such dimensions as to care for anticipated production in the near future.

In Table II are shown the percent-

the direct synthetic methods and the decreasing importance of the other processes are clearly evident from these figures.

It may be readily inferred that the direct synthetic plants must possess some marked superiority over the other methods of nitrogen fixation. This superiority is mainly in the comparatively small amount of power required by the direct synthetic method, although the character of the product obtained offers some advantage.

The product obtained from the arc process is nitric acid. To make this available for fertilizer, it must be combined with some basic material and lime recommends itself as being cheap and suitable for addition to the soil. But the product, calcium nitrate, absorbs moisture and is a difficult material to handle because of the stickiness imparted when water is absorbed. This

TABLE II—PERCENTAGE OF TOTAL SYNTHETIC NITROGEN BY DIFFERENT PROCESSES

Processes	1913	1914	1920	1926
Cyanamide.....	57.4	54.6	27.8	23.7
Direct Synthetic.....	10.9	16.9	63.4	70.8
Arc and Other.....	31.7	28.5	8.8	5.5

ages of nitrogen produced by the different fixation processes for the years 1913, 1914, 1920 and 1926, based on the

necessitates further treatment to overcome this undesirable property.

The product obtained from the cy-

anamide process is calcium cyanamide, a substance that can be used alone as a fertilizer under certain conditions with proper care. It is used thus in European countries on a rather extensive scale, but its use in this country has been in mixed fertilizer. It can be employed this way in only limited quantities in view of the fact that beyond a small proportion when mixed with acid phosphate it causes a reversion to insoluble phosphate. By additional treatment, however, other products may be obtained from cyanamide. Ammonia may be obtained by treatment with steam and the ammonia may be oxidized to form nitric acid. This nitric acid can be neutralized with an additional quantity of ammonia to form ammonium nitrate. Muscle Shoals Plant No. 2 is equipped to carry out all these operations. Ammonium nitrate is a desirable fertilizer material from the standpoint of nitrogen content as it contains about 35 per cent nitrogen, part as ammonia nitrogen and part as nitrate nitrogen. But it has the undesirable property of absorbing moisture from the air, so that special treatment is required for its use as fertilizer.

The product obtained from the direct synthetic process is ammonia, a gas at ordinary temperature and pressure. It is therefore necessary to combine it with some acid, or form some compound suitable for fertilizers. As ammonia may be derived from the cyanamide process as well as from the direct synthesis, the treatment may be similar from this point, or there may be a difference of treatment involving the use of carbon dioxide derived from purification of hydrogen in the direct synthesis method.

#### DEVELOPMENT OF NEW FERTILIZER MATERIALS

With the large production of ammonia from direct synthetic processes,

studies have been made of the methods of utilizing the products as fertilizers, and many new forms of fertilizers have been suggested. Many of the compounds have been prepared and studied by the United States Department of Agriculture, but it is principally in Europe and especially in Germany that they have been produced on a commercial scale. If phosphoric acid can be produced cheaply, it may be used to combine directly with ammonia to form ammonium phosphate, a salt carrying both nitrogen and phosphorus and about 75 per cent of the weight as fertilizer constituents. Other products that it is possible to form, high in plant food constituents, are ammonium nitrate, calcium nitrate, potassium nitrate, urea, ammonium chloride, ammonium sulphate and potassium phosphate. By combinations of these it is possible to make fertilizer mixtures that contain the three principal fertilizer elements in varying amounts and in high concentrations. There are difficulties in the handling or keeping of some of the products, but methods of overcoming these difficulties are being rapidly developed, and it is probable that in the future with the increasing use of fertilizer and the decreasing production from the present sources of material, the strictly chemical fertilizer will form the basis of the fertilizer industry. This must await not only the development of the technology of manufacturing ammonia and phosphoric acid cheaply enough to compete with nitrogen and phosphorus in the present day fertilizer, derived from other sources, but must also await the education of the farmer to the use of new and unfamiliar materials. The most economical method must be employed to manufacture these materials and the history of nitrogen fixation shows the commercial displacement of the cyanamide process (the process of



Plant No. 2 at Muscle Shoals) by the direct synthetic process.

The manufacture of these new forms of fertilizer is dependent not only on the solution of technical problems, but on the economic situation. It is generally agreed that the development of the fertilizer industry is definitely toward concentrated materials. Definite knowledge must be available as to the properties and use of these materials before they will come into wide application. While the Department of Agriculture has been investigating the possible compounds suitable for fertilizers and the properties of these compounds and has tested their field application, there still remains very much to be done, before these concentrated fertilizers can be introduced into general practice in farming.

#### RELATION OF MUSCLE SHOALS PLANTS TO POWER

The association in the public mind of nitrogen fixation with power, and with fertilizers has led to the belief that the Muscle Shoals plants can be economically operated for the production of fertilizers because of the power available there. Nitrate Plant No. 2 at Muscle Shoals is a cyanamide plant and this method for fixation of nitrogen is already being rapidly displaced throughout the world by the direct synthetic methods. The consumption of power by the cyanamide process is about four times that of the synthetic processes. Plant No. 1 at Sheffield, based on the direct synthetic method, was designed for only one-fifth the capacity of Plant No. 2, and only a portion representing about one-fourth its capacity was ever completed sufficiently to make a test run. It was shown that this plant would have to be rebuilt to be operative. The cost of remodeling the plant would be considerable. In addition, the cost of

power is not an important consideration in the operation of this process.

To operate Plant No. 2 at Muscle Shoals would be to utilize the power in fixing nitrogen by the process that is being rapidly displaced in the competitive markets of the world. To use the power for the operation of the direct synthetic process, it would be necessary to construct a plant based on the latest developments in this field, developments that have shown hydroelectric power unnecessary in its operation. The use of this power for the commercial operation of either process would be inadvisable, since it would employ it either in an uneconomic or an unnecessary manner and would prevent its utilization in processes where it is essential, or its distribution for industrial and domestic purposes. This is of real importance, for Muscle Shoals is so located that the demands upon its power, especially to the West and South, will undoubtedly increase.

Hydroelectric power is not necessary for nitrogen fixation by the direct synthesis method. This method employs the gases hydrogen and nitrogen and brings about their combination as ammonia under pressure, at a temperature of around 500° centigrade in the presence of a catalyst. In the first and largest plants of this sort, constructed in Germany, the hydrogen and nitrogen mixtures were prepared by the reaction of air and steam on coke in gas producers and purified before use for combination as ammonia. The principal power requirement is in the compression of the gases to several hundred atmospheres before they enter the reaction chamber, and this power can be obtained just as readily from coal as from water.

It is possible to obtain hydrogen from water by electrolysis and in this method electric power is necessary. However, the direct synthesis process

when operated with electrolytic hydrogen requires about 20 per cent more power than the cyanamide instead of 75 per cent less when chemical means of producing the hydrogen are used. Hence the electrolytic hydrogen is used principally where it is obtained as a by-product from an electrochemical process as in the manufacture of chlorine. There are a number of places where waste hydrogen is being produced as a by-product and this hydrogen may be utilized in the direct synthesis process.

The possibilities in the production of ammonia make the situation somewhat uncertain but show a definite drift toward the use of coal in producing hydrogen. This makes it unwise either to tie up for a long time any considerable amount of water power in a process that is being rapidly superseded, or in using it in a process in which power is of minor significance.

The fact that nitrogen fixation is more closely allied with coal than with hydroelectric power makes it more important for the economical development of the industry that the plants be close to coal producing centers. Such locations also have the advantage of distributing the nitrogen fixation plants and from the standpoint of fertilizer distribution would be an additional saving in freight rates over that due to the production of the more concentrated products already referred to.

#### THE SITUATION AT MUSCLE SHOALS

At Muscle Shoals there is a large water power available, developed for use in fixing nitrogen by a process that at the time was well understood and dependable. This process is now being rapidly displaced throughout the world by the direct synthetic methods, in which hydroelectric power is not necessary. The power not necessary for nitrogen fixation will find a market

in the rapidly developing public utilities and industries of the region.

Of the two plants at Muscle Shoals, Plant No. 1 is of small capacity and will require reconstruction to be put in operative condition on a process for direct synthesis of ammonia, and Plant No. 2 is a complete cyanamide plant of 40,000 tons nitrogen capacity, built as a war-time necessity, but tending toward obsolescence because of the rapid development of direct synthetic methods. The present day development of nitrogen fixation does not require hydroelectric power. In fact the industry is more closely allied to the coal industry than to water power.

The commercial development of nitrogen fixation plants in this country is taking place rapidly as evidenced by the establishment of a number of direct synthetic plants, and the projection of plans for other plants by two of the largest chemical manufacturing concerns in the country. Large amounts of new types of fertilizers from the nitrogen fixation products will not be produced, however, until the market develops for these materials; and the market must be developed through a campaign of education regarding the properties and use of the new materials. It is inevitable that the use of fertilizers will increase and the area of use widen, also that, with the present sources limited, the concentrated chemical products will form the basis of the future fertilizer industry.

Plans for the utilization of Muscle Shoals have ranged from private lease and operation of the power and nitrogen fixation plants to government ownership and operation of both; and from the separation of power and nitrate plants under private operation to the sale of power, and the operation of the plants by the government for experimental and educational purposes in developing the new forms of ferti-

lizers. Whatever the solution of the problem is, it should take account of the ultimate demand for hydroelectric power in that region, the development of the nitrogen fixation industry in relation to power, and the development and introduction of the new fertilizer materials.

## Nitrogen at Muscle Shoals

By CHESTER H. GRAY

Washington Representative, American Farm Bureau Federation, Washington, D. C.

**I**T is difficult to write regarding the Muscle Shoals project and confine oneself to the single aspect—nitrogen. This project has several truly national features which are from various points of view fully as important as is the nitrogen phase.

When Congress first authorized the location of a nitrogen fixation project and authorized the then President of the United States to make a selection of location for this project, there were at least four national characteristics thought of. At that time, the most important phase of the project, of course, was preparedness, or national defense. That aspect never, even in peace times, can be lost sight of. Then, taking second place in the category of national features connected with this project, was the production and distribution of fertilizers. It was then known, and has later come to be much better understood, that the same equipment down to a certain point in the process of manufacture which secures preparedness in the way of producing nitrogen, also makes it possible to secure fertilizers. A third feature which is connected with the Muscle Shoals project is that of river transportation. Too often, this aspect of the project is entirely lost sight of, but it is important enough in connection with the project to justify the statement that unless the Tennessee River is kept in mind throughout its navigable length as a transportation project, never can we expect the fullest development of fertilizer making at the Shoals.

The last feature and the least important from a national point of view

is the power development at the Shoals. In the mind of Congress when the ordaining act was passed, power at Muscle Shoals was useful for one temporary purpose, only—that of preparedness, and for one permanent purpose, only—that of operating our preparedness and fertilizer factory in the locality of Muscle Shoals. Any separation of the power at Muscle Shoals from the preparedness and fertilizer aspects of the project is a departure from the ideas which evidently were in the Congressional mind when the soil was first broken at the construction period upon this project.

Unless one views, then, the Muscle Shoals undertaking in its broadest national way and from more than one point of view, it is difficult, if not impossible, to visualize its complete significance to our national life. It is an undertaking which in very direct ways in times of war or of peace brings rewards to each and every one of our citizens; but unless Congress views it in the broadest national way and not from one point of view, it may lose its entire national significance and become nothing more than a power station such as can be found in many other localities elsewhere in the nation.

### TYPE OF LEGISLATION NEEDED

The practical thing for us to do at this time, then, is to consider what type of legislation we should have in order to secure for our entire citizenship the four national characteristics above set out, namely, preparedness, fertilizers, river transportation, and power. In considering this practical legisla-



tive side of the question, we find three groups which are advocating three somewhat diametrically opposed points of view before Congress. These groups are: the farmers who want private operation under an iron-bound contract that certain specific things at the Shoals will be done. Then, we find the governmental operationists who want Uncle Sam to operate the entire project at Muscle Shoals, and secure by that method of operation whatever benefits can accrue from the project. Finally, we have the power interests which have, from the beginning and quite naturally, wanted to have the operation of the project under their control so that there would be no competitive power offered for sale in the Southern territory.

The controversy revolves around the question of the fixation of nitrogen and the making of fertilizers, of course. Sometimes, the transportation and the preparedness aspects are either neglected or utterly forgotten. Never, though, is the power aspect of the situation either neglected or forgotten. In fact, the controversy is, in some ways, more of a wrangle for power than it is an advocacy for preparedness and fertilizer making.

#### NITROGEN FIXATION

The first activity, though, which all must consider at the Shoals if we want to begin at the bottom is the fixation of atmospheric nitrogen. Unless the project is made to operate in the fixing of nitrogen, the subsequent making of fertilizers cannot be expected and if the large national aspects of the projects are forgotten, we may expect that the transportation feature will be allowed to fall by the wayside, also. But in the matter of nitrogen fixation, we hear much these days about processes. In some ways, the arguments are made almost wholly in regard to

the efficacy of the various processes for fixing atmospheric nitrogen. Truth to say, the Muscle Shoals enterprise has nothing to do with the quarrel as to which process is best or which is worst. In fixing atmospheric nitrogen at Muscle Shoals, we are faced with a business proposition more than a chemical and research one. Knowing that the cyanamid process will fix atmospheric nitrogen, the business proposition we necessarily must consider is this: Shall we junk the entire enterprise and let it degenerate into merely a power station, or shall we put the enterprise at work fixing nitrogen, first of all, and later manufacturing and distributing fertilizers?

Nitrogen fixation is comparatively, as all know, a new commercial undertaking. It is like most other business enterprises in that there is no one absolutely best method for fixing nitrogen. If there were some other process installed at Muscle Shoals than the cyanamid one, and if conditions for that other process, whatever it might be, were such as the process necessarily must have, then the business proposition facing us would be to make that process operative.

#### THE VARIOUS PROCESSES

The Muscle Shoals controversy now is not, when properly considered, a battle between and among the processes. More accurately, it is a battle for power, meaning whether the power shall be used to fix nitrogen and make fertilizers, or whether it should be distributed over transmission lines and sold at the prevailing kilowatt hour rates. It need not be maintained that the cyanamid process is greatly superior to any other known process, nor need it be asserted that any other process is so perfect as to eliminate every other method of nitrogen fixation. The so-called synthetic processes—the

most commonly known one being the Haber and modifications thereof—are good and undoubtedly are proving themselves efficient where conditions are advantageous to their operation. One such condition necessarily must be cheap coal. If a Haber plant should be located in the anthracite coal region of Pennsylvania where coal is high in price, one might reasonably state that it would be uneconomic in its production of fixed nitrogen. Such location would not be an argument to maintain that the Haber process is obsolete—to locate a Haber plant in such environment would merely be to place a good process in a bad location.

If the cyanamid plant at Muscle Shoals had been located at Des Moines, Iowa, where power is not cheap and not available in large quantities except at high prices, the plant built on this location would be, as we state, "a fish out of water." Such a location in the case of the cyanamid process would not demonstrate that the process is obsolete, but merely that it was disadvantageously located.

What is meant by the above statements, briefly, is that various processes are good, but that each of them must be placed where conditions are suitable for its operation. A condition of a Haber process plant is cheap coal; a condition of a cyanamid process plant is cheap power. Since, then, we have a cyanamid plant where cheap power can be made available, provided such power be not transmitted for other uses over long distances, we may conclude that it is advantageously situated and can be made to operate comparably to other cyanamid plants in other parts of the world where such plants are located close to the cheapest power known which is hydro-electric power. At this time, however, the cyanamid plant at Muscle Shoals is the only such plant in the world idle, owing to the

Congressional inability to make up its mind what to do with the entire Muscle Shoals project.

Those who advocate the beginning of operations at Muscle Shoals at Nitrate Plant No. 2 cannot be said to be opponents of any other process for nitrogen fixation which is known. Such persons can, however, be said to commend the cyanamid process which is installed at the Shoals for operation under conditions which that process must have to operate successfully in any part of the world. All who advocate the beginning of operations at the Shoals in the fixing of nitrogen and the making of fertilizers want a "free field and no favors." Neither tariff duties nor opposition to the introduction of other fixation plants in our nation are being advocated as methods to protect the operations at the Shoals. Muscle Shoals, when it begins to operate, must meet world competition in fixing nitrogen and in making fertilizers. If it cannot meet this world competition, it will have been proven to be an uneconomic venture. Such a development would be true no matter what process might have been installed in the beginning at the Shoals.

Referring to obsolescence which is so much heard of now in connection with nitrogen fixation, it may be stated absolutely that the only process which is obsolete is the one which cannot meet world competition. Thus far, neither the Haber nor the cyanamid process has been proven in this method of definition obsolete, for they are at the present time meeting competition of the entire world and greatly extending the sale of products made by the two processes.

#### THE CYANAMID PROCESS

But applying ourselves for a while more specifically to the cyanamid process since it is more commonly said

to be obsolete and so described mostly by those who for various reasons do not care to see Muscle Shoals made operative except for power, let us see what the situation is relative to that process. Fifteen years ago, the total annual capacity of all the cyanamid plants in the world was only about 60,000 tons of cyanamid. Today, there are at least twenty-eight cyanamid plants all in operation in different parts of the world from which we have an annual tonnage of cyanamid somewhat in excess of 1,000,000 tons.

On the American continent, the fixation of domestic nitrogen began at Niagara Falls in Canada with an annual capacity of 5000 tons of cyanamid. The capacity of this plant has steadily grown until last year, 1925-26, the plant was producing at the rate of 120,000 tons of cyanamid per year. Down at Muscle Shoals we have a cyanamid plant about this same annual capacity which is, singularly, idle and is alone in that regard among cyanamid plants anywhere in the world.

In a recent month this plant at Niagara Falls, Canada, produced 11,000 tons of crude cyanamid or at the rate of 132,000 tons per year. This monthly production was equivalent to 2500 tons of nitrogen or at the annual rate of approximately 30,000 tons per year. This does not look much like obsolescence when we make comparisons of the above mentioned amounts with our importations of Chilean nitrates.

Taking the world's production of cyanamid of 1,000,000 tons annually, and using the very low yield of 17 per cent of fixed nitrogen, this gives 170,000 tons of fixed nitrogen as the world's annual production at all cyanamid plants. Our importations of Chilean nitrates are about 1,000,000 tons annually, yielding approximately 15 per cent of nitrogen. This gives us from our importations of Chilean nitrates

150,000 tons of nitrogen annually. We see, then, that the fixed nitrogen produced at all cyanamid plants in the world is 20,000 tons in excess of our total importations, annually, from Chile. In view of these facts, it is hardly possible to maintain that the cyanamid process is obsolete, for to do so one had as well maintain that Chilean nitrates are likewise obsolete.

The nitrate plant No. 2 at Muscle Shoals is by common acceptance now capable of producing 50,000 tons of fixed nitrogen annually. Since Chilean nitrates yield about 15 per cent nitrogen and with agriculture in the United States using about 660,000 tons of the Chilean products, annually, we find that we are importing for agricultural purposes about 100,000 tons of nitrogen, annually, from Chile. Since the plant at Muscle Shoals has an annual capacity equal to half this amount, it is inaccurate to claim that the Government's cyanamid plant at Muscle Shoals is obsolete or should any longer remain idle. It is a neglect of the national defense of the country and a disregard of the needs of agriculture that the plant has remained idle as long as it has.

#### INCREASED USE OF CYANAMID

Another approach to the question of obsolescence in regard to the cyanamid process is a study of the increasing use of raw cyanamid in the world. For instance, we find in a report issued by the Chemical Division of the United States Bureau of Foreign and Domestic Commerce the information that in 1913 Italy consumed 15,000 metric tons of cyanamid. This consumption had risen in 1926 to 86,000 metric tons. The Commercial Attaché of the United States at Brussels, Belgium, reports that for 1926 30,000 tons of Chilean nitrate, 25,000 tons of sulphate of ammonia, 32,000 tons of cyanamid, 4000

tons of nitrate of lime, 2000 tons of guano were imported and used in Belgium. These figures show a total consumption of nitrogen in Belgium of approximately 16,000 tons. Assuming that the 32,000 tons of cyanamid was of a reasonably high efficiency and carried 20 per cent of nitrogen, we find that nearly half of the total nitrogen imported into this nation was in the form of cyanamid. From a recent Moscow, Russia, publication, we are informed that the first atmospheric nitrogen fixation plant to be constructed in that country is to use the cyanamid process and will start out with an annual capacity of 10,000 tons.

#### IMPROVEMENT OF PROCESSES

Various nitrogen fixation processes have gone through the usual evolutions towards becoming more perfect in their operation. The Haber process now, undoubtedly, is more efficient than was the case in 1916. Its efficiency, under the conditions which it must have to be successful, is demonstrated by the increased production of the plants in various nations which have installed this particular process for fixed nitrogen. No doubt, the Haber process will, in future use, be developed beyond the point where it now stands. In the case of the cyanamid process an equal progress is noted. For instance, in 1910 the product of the cyanamid process in America contained not over 17 per cent nitrogen; in 1917, this percentage had increased to about 21 per cent, while at the present time the crude product before it is converted into fertilizer carries 23.5 per cent of nitrogen.

Further efficiency developments in the cyanamid process are found in the increase of furnace sizes which has meant a corresponding decrease in the power consumption per unit of product. Taking the power consumption in 1910

per unit of product as 100, the present consumption of power in 1927 in the large furnaces with improved control stands at 63. Stating this information in a different way, we find that in the earlier periods of production using the cyanamid process a short ton of nitrogen consumed about 3 horsepower-years. In 1912, the power factor per short ton of nitrogen had decreased to 2.5 horsepower-years. Tracing this development down to more recent years, we note that in 1916 Dr. Charles L. Parsons, at that time connected with the United States Bureau of Mines, stated as his opinion that the cyanamid process required 22 horsepower-years per short ton of nitrogen. In striking opposition to this very high estimate is the solid fact that the cyanamid process is now operating under American conditions with an average consumption slightly less than 2 horsepower-years per short ton of nitrogen.

Since the cyanamid process is one of mechanics more than of chemistry, the product can be secured on large scale operations with a minimum employment of labor. This, also, effects a great lessening of the cost factor in the final product. As compared to the production of synthetic ammonia, by using the cyanamid process, approximately two men of every three are eliminated, and the one man left is of that characterization known as the common laborer, whereas under the synthetic production of ammonia, the three men required are really technologists, and under American conditions would require to be paid very high wages.

Perhaps it is not necessary to give so much attention to the question of obsolescence, but if we are dealing with the question of nitrogen at Muscle Shoals, and it can be demonstrated that any particular process, cyanamid



or otherwise, really is obsolete, we should at once eliminate that process from further consideration by Congress. Information such as just given, however, does not give strength to the assertion that the cyanamid process is obsolete.

#### HOW SHALL WE GET NITROGEN AT MUSCLE SHOALS

Now, the question is: What shall be done in order to get nitrogen at Muscle Shoals? The farmers are the only group which have had from the beginning a consistent nitrogen fixation-fertilizer program at the Shoals. Their program now, as it has been from the beginning, is in favor of leasing the project as a unit to a lessee, thus again committing the farmer to the idea that private operation is to be preferred over and above government operation of this or similar undertakings. Title to properties shall reside perpetually with the United States, and the duration of the contract shall be fifty years. Iron-bound terms must be in the contract which will require the lessee to

reach maximum production in as short a time as possible and sell and distribute such production under the jurisdiction of a Muscle Shoals farmer board. The products to be made at the Shoals shall be such as will carry not less than 40 per cent plant food, and there must be no separation of power available at Muscle Shoals from the fixation of nitrogen and the making of fertilizers. The Government must be protected in this contract in regard to payments, both amortization and interest, so that in time it will recover from the lessee the reasonable peace-time costs of the project and still retain title thereto. All this and more is incorporated in the Madden bill, H. R. 441, 70th Congress.

Any proposal which deviates from the above fundamental features of the lease can be accused of not carrying forward the original intent of the Congress when the Muscle Shoals project first was authorized, and assuredly can be criticized as being not what the farmers desire from this great undertaking.

# The Public Service of Muscle Shoals

By MRS. HARRIS T. BALDWIN

Chairman, Committee on Living Costs, National League of Women Voters

**M**USCLE SHOALS is a war legacy. Before 1916 our chief source of supply of nitrates needed in the manufacture of munitions was Chile. It was thought that if we entered the World War we should have some means of producing those nitrates in this country. The National Defense Act was passed June 3, 1916. Clause 124 of that Act authorized the President to select one or more sites in this country where cheap water power could be developed for the purpose of extracting nitrogen from the air. The nitrates produced were to be used for munitions in time of war and in the manufacture of fertilizers and other useful products in time of peace. The Act further provided that the plants should be operated solely by the Government and not in conjunction with any other industry or enterprise carried on by private capital.

President Wilson chose the Muscle Shoals at Florence, Alabama, on the Tennessee River. Power was needed for construction work, and the first thing done was to enter into a contract with the Alabama Power Company, which had a steam plant at Gorgas, the mouth of a coal mine, 90 miles south of Muscle Shoals. The plan of work at Muscle Shoals called for three dams, two navigation dams and one power dam, two nitrate plants, two electrical steam plants, power house, lock, industrial village, and the purchase of a large tract of land and the Waco lime quarry. When the armistice was signed in 1918, \$105,000,000 had been expended, two nitrate plants and the steam plants were completed and some

work had been done on the power and navigation dams. The immediate need for nitrates was passed, and so the question of the disposition of Muscle Shoals came before the Congress.

## CONGRESSIONAL ACTIVITY ON MUSCLE SHOALS

To go into the detail of Congressional activity since 1918 would take far too much time and space. Each year several proposals have been presented to Congress without success. In the spring of 1925 President Coolidge appointed five men to serve on a Muscle Shoals Commission. The duty of this Commission was to assemble reliable information for Congress as to the production of nitrates and to report not later than November 15, 1925, upon the most practical method of utilizing the nitrate plants to the best advantage. During the first session of the 69th Congress four bills and one resolution were introduced. By the passage of the House Concurrent Resolution No. 4 in March, 1926, a joint committee on Muscle Shoals was created. This committee was composed of three members from the Senate Committee on Agriculture and Forestry and three members of the House Committee on Military Affairs. They were authorized to conduct negotiations for a lease or leases of the properties at Muscle Shoals and in April, 1926, they recommended a proposal by thirteen allied power companies and submitted a bill embodying this offer.

The first and second sessions of the 69th Congress adjourned without taking any action on this bill, and the

problem of Muscle Shoals remains unsolved.

In the meantime, however, Congress has made provision for continuing construction work on the dams and power house. In 1918 the preliminary work at Wilson Dam such as construction of camp, roads, railroads and coffer works was begun together with the purchase of supplies and equipment. This work was stopped in August, 1918, by order of the War Industry Board and resumed in November of that year. Work on the lock and dam and power house was continued until June, 1921, when because of lack of funds it was gradually shut down until it was practically on a maintenance basis, and it was not until the fall of 1922 that funds were available to actually resume work.

Wilson Dam and the power house were completed in 1925, and the first generator to be put under load was in September of that year. This work has been done under the supervision of army engineers.

#### LEAGUE OF WOMEN VOTERS AND MUSCLE SHOALS

Since 1921 the National League of Women Voters has had Muscle Shoals on its program. For five years the League studied it carefully from all angles. And in the Convention of 1926 the League went on record as favoring Government operation of Muscle Shoals.

It has been my privilege within the last month to be one of the two members of the National League of Women Voters to visit Muscle Shoals. For six years we have attended the Congressional hearings, we have sat in the gallery of both the House and the Senate and listened to the debate on the floor, we have read everything available and have talked to many

people regarding its disposition. Within the last year statements have been made which have in part contradicted much that we had read. We were told that Muscle Shoals was in a run-down condition, going to rack and ruin, that rust was the predominating color at the nitrate plants, that the potential power there was of no importance to the South. In fact one of our League members living in a southern state received with her October electric light bill a flier which read in this manner: "Do not believe all you read and hear about Muscle Shoals; there is not power enough there to supply more than one small town." We decided to go and see for ourselves.

There was no rust. It came to us forcibly when we first stepped into one of the buildings of the nitrate plant No. 2. For nearly ten years the machines have stood idle, yet each was cleaned, polished, oiled. The only rust we saw was on a small scrap heap which had been dumped from some other war activity and which the Army Engineer in charge of Muscle Shoals had no authority to move. We looked for signs of deterioration and ruin, and were only conscious as housekeepers that Uncle Sam knew how to keep property under his care in excellent condition.

Our first desire was to see Wilson Dam and the power house, and to check up on the statement that the power developed there was of no great importance. It would be impossible to describe the physical structure of Wilson Dam. To a woman it seems nothing short of a miracle that human hands working against such odds could build it. The mere mathematics of it are almost beyond her ken. What she can understand, however, are the possibilities of such a project once it is finished.

## POWER FROM MUSCLE SHOALS

It was in the power that our great interest centered, because we had a vision of what power from Muscle Shoals might mean to the homes in that region. While we wait for Congress' decision some power is being generated and sold to the Alabama Power Company. Eight units in the power house are ready to be put in operation and there are wheel pits for ten more units. Not more than four units have been in operation at a time. We learned the "flier" to the contrary that it was not because of lack of power, but because of the inability of the Alabama Power Company to take it away. According to the figures of the Army Engineer in charge the capacity of the Alabama Power Company transmission lines from nitrate plant No. 2 is 120,000 kilowatts with normal line losses, and this capacity can be increased to 130,000 kilowatts by overload.

We were given to understand it would cost the Alabama Power Company several million dollars to build transmission lines capable of taking away the power which can be developed. One reason why this has not been done is because with the fate of the Muscle Shoals still undecided no long-time contract may be made. Hence, on thirty days' notice the Government can stop selling power. For this power which the Government sells the Alabama Power Company pays 2 mills a kilowatt hour—it is sold in Alabama up to 8 cents a kilowatt hour.

These are the figures given us by the Army Engineers on the revenue received from the sale of electric energy generated at Wilson Dam from September 12, 1925, to October 31, 1927:

September 12 to October 31, 1925..	\$73,453.37
January 1 to December 31, 1926...	872,617.47
January 1 to October 31, 1927....	1,020,535.78

Total.....	\$1,966,606.62
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During the operating period in 1925, the hydraulic and electrical machinery was being tested and it was impracticable to run more than one unit at a time, and operation was intermittent, due to the necessity of changing connections, making adjustments, etc. The testing continued to March 31, 1926, but four units were available after December 31, 1925. April 1, 1926, is taken as the date on which the plant was placed in commercial operation.

No power was sold from July 5 to 15 inclusive, 1926, during which time a new agreement was under consideration by the War Department and Alabama Power Company.

The money received from the sale of power is deposited in the Treasury of the United States as "miscellaneous receipts."

It is interesting to compare the annual revenue from three or four units at 2 mills per kilowatt hour with the best power bid which has as yet been submitted. If the Government accepted this bid it would receive during the fifty years of the lease \$600,000 per annum for six years, \$1,200,000 per annum for the next six years, \$1,500,000 per annum for the next six years and \$2,000,000 per annum for the remaining thirty-two years.

We were intensely interested in the figures of Mr. J. C. Stiles, who is engaged in power study work under the district engineer at Florence, which showed the relative output of electric energy in several southern states. According to his figures the public utility companies in the state of Alabama, including Wilson Dam, produced in 1926 1,582,717,000 kilowatts; in Georgia, 710,578,000 kilowatt hours; in Mississippi, 58,667,000 kilowatt hours, and in Tennessee, 894,015,000 kilowatt hours. The kilowatt hours produced at Wilson Dam during that



period were 436,308,735 kilowatt hours. Mr. Stiles figures that Wilson Dam is capable of producing from 1,500,000,000 to 2,000,000,000 kilowatt hours per annum.

Muscle Shoals has a weak spot which must be considered. The flow of the river is far from constant; it varies with the seasons; the primary power in round numbers is 100,000 horsepower. Yet at times of the year enough water goes over the dam to make a million horsepower. There are two ways of equalizing the flow: by storage dams and by supplementary power from steam plants. Already estimates have been made for a second power dam at Cove Creek on the Clinch River. If this were constructed it would double the primary power at Wilson Dam.

#### GOVERNMENT OPERATION OF MUSCLE SHOALS

One of the reasons underlying the League of Women Voters' stand for Government operation of Muscle Shoals was the feeling that Muscle Shoals and the Tennessee River should be developed as one project, that there are three phases of such project, power, flood control, and navigation. The Tennessee River flows through the heart of the South. In its unimproved state it is not navigable. Senator Norris of Nebraska writing in "The New South," July, 1927, says regarding navigation, "In order to secure to the people of the South the use of their own property, it was proposed in Congress that the Government should make a complete survey of the Tennessee River and all its tributaries, and that there should be built from time to time during the next ten or fifteen years, a network of dams for the improvement of navigation, the control of flood waters, and the development of electricity. It is only by dealing with a system of this kind we can get the

maximum amount of benefit from the minimum cost."

#### AID TO NAVIGATION

An attempt to aid navigation in a small way has been made at Dam No. 1, which is a navigation dam. Dam No. 3 is to be a navigation dam also, but work has never really been started on it. The chief of engineers has stated that \$9,000,000 is a fair assessment for the benefits to navigation of Dam No. 1, and the President's Muscle Shoals Commission estimated \$10,000,000.

Wherever Muscle Shoals is discussed there is always the cry "cheap fertilizers for the farmer." It has come almost to be a political slogan. There are those who think that the power at Wilson Dam should be used exclusively for the manufacture of fertilizers in time of peace. They think that if the nitrate plants are leased Wilson Dam should be included and if there is excess power it may be sold by the lessee. There are others who feel that it is a questionable thing to lease on those conditions. It has never yet been satisfactorily proven that cheap fertilizers can be produced at nitrate plant No. 2.

At the time the National Defense Act was passed it was generally believed that by the use of cheap power we would be able to take nitrogen from the air at a cost that would lessen the cost of fertilizer.

The Arc process was the first method used to take nitrogen from the air; it required a great deal of cheap power. The cyanamid process was discovered to take much less power. It was known that the Germans were working on a method said to be a great improvement over the cyanamid process. This was known as the Haber process. While the details of this process were not fully understood, still the experts thought there was a chance to con-

struct a plant using this process to extract the nitrogen from the air. Nitrate plant No. 1 was in the nature of an experiment and was a total failure.

The building is supplied with a steam plant and can be used for other commercial purposes. Since the war, however, we have learned the details of the Haber process. Constant improvement is being made, and with every new improvement less and less power is needed. Today anyone constructing a nitrate plant locates it near the source of cheap coal rather than water power.

Nitrate plant No. 2 is constructed to extract nitrogen from the air by the cyanamid process. It is capable of extracting 40,000 tons of nitrogen from the atmosphere in a year. The process is not obsolete, but experts say the time is not far distant when it will be. The American Cyanamid Company has submitted a bid for nitrate plant No. 2 which includes Wilson Dam.

Are we going to sign away our property for fifty years? Are we sure that

the American Cyanamid will produce a fertilizer which will be cheap for the farmer? Is it not possible that within a period of fifty years experimentation in the manufacture of nitrates will reach the place where very little power will be used even in the cyanamid process? Who will get the benefit of the sale of the surplus power from Wilson Dam, and is the rental which the Cyanamid Company offers large enough to repay us for investing about \$160,000 and for giving up our property for half a century?

The late Walter Durand in his last article called attention to the "need for public yard sticks" by which public and private ownership of power enterprises might be measured. We are constantly being told that public ownership will not work. We have no great public power enterprise and therefore no means of comparison, and the National League of Women Voters feels that Muscle Shoals rightly developed could be used as a "public yard stick."

## Book Department

LATANÉ, JOHN H. *A History of American Foreign Policy*. Pp. xiv, 725. Price, \$4.00. Garden City: Doubleday, Page and Company, 1927.

The general interest in questions of international relations since the World War and the new courses being offered on that subject in our universities and colleges have been recently met by a number of volumes which attempt to present the foreign policy of the United States as a continuous development from its beginnings to the present day. The volume before us is the latest of these, and it will receive a cordial welcome from the public at large as well as from academic circles. For it is not only a scholarly treatise, such as might have been expected from one of the author's professional standing, but is at the same time an unusually readable story, told in easy narrative form, made graphic by the introduction of numerous quotations from documentary material, and interspersed with the author's comments and occasional vigorous criticisms.

*A History of American Foreign Relations* might perhaps be a more descriptive title. For the volume covers all of the important incidents in the diplomatic intercourse of the United States and introduces a number of topics and much historical detail which could scarcely come under the head of "Foreign Policy" if by that title is meant the principles which more or less consistently have guided the United States in its relations with other states. The chronological method, inseparable from a history, is relieved by a topical treatment consisting of six periods, each marking a new trend in our foreign relations. "Republican Principles and Ideals" covers both the French Alliance and the policy of neutrality. "Defiance of the Old World" includes the struggle for neutral rights and the announcement of the Monroe Doctrine. "Rounding Out Seas and Looking Over Borders" deals with territorial and commercial expansion and the opening of the Far East. "Safeguarding the Union" is concerned primarily with the diplomacy of

the Civil War, while "Expansion in Caribbean and Pacific" and "Intervention in Europe" take up the more recent phases of American diplomacy.

Among the many judgments which the author expresses upon men and events it is interesting to note his defense of Jefferson's position in 1793, his legal justification of the Louisiana Purchase, his criticism of the anti-slavery tradition with respect to the annexation of Texas and the Mexican War, his defense of the Clayton-Bulwer Treaty, and, coming down to more recent times, his sharp criticism of Secretary Hughes' policy towards the League of Nations. The survey of the events leading up to American participation in the World War and of the attitude of the Senate towards the League of Nations is written with a conscious effort at impartiality, although it is clear on which side the sympathies of the author lie. A closing chapter asserts that the present policy of "Coöperation without Entangling Alliances" is "an empty formula" and "a species of camouflage," and points out that both the economic rehabilitation of Europe and the problem of disarmament are fundamentally political questions.

The typography of the volume is quite equal to its contents. The marginal headings are an undoubted help to the student, and the blocking of direct quotations from documentary material will be of great assistance to teachers in using the volume as a basic text. Professor Latané's volume is destined to have a wide circulation in our universities and colleges and it is to be hoped an equally wide circulation outside of academic halls in view of the urgent need for accurate and unbiased information upon American foreign policy in the light of its past traditions.

C. G. FENWICK.

SAENZ, MOISES and PRIESTLEY, HERBERT I. *Some Mexican Problems*. Pp. ix, 174. Price, \$2.00. Chicago: The University of Chicago Press, 1926.

These six lectures on Mexico were delivered during the summer of 1926 before the

Third Institute on the Harris Foundation at the University of Chicago. The first three deal with the Program of the Mexican Government and were delivered by Señor Moises Saenz, Subsecretary of Education of Mexico. The last three lectures are by Herbert I. Priestley, Librarian at the University of California, author of the best recent history of "The Mexican Nation" (1923), and an acknowledged authority on that country.

This small volume contains a keen critical analysis of present conditions in Mexico. Its discussions of the recent relations of the United States with its southern neighbors are most enlightening. Señor Saenz maintains that there has been but one revolution in Mexico since 1910—the continuous fight of the landed aristocracy against the people, of "privilege against destitution." He shows the marked progress made by labor in his country under the influence of the American Federation of Labor. His discussion regarding the influence of American capital and commerce in Mexico tends, however, to be an *ex-parte* statement; it leans toward nationalistic resentment rather than scientific accuracy.

Dr. Priestley's discussions are masterly—neither fulsome praise nor passionate condemnation of American policies. They supplant the querulousness of diplomatic legalisms with a warmth of neighborly respect and admiration.

HARRY T. COLLINGS.

RIPLEY, WILLIAM Z. *Main Street and Wall Street*. Pp. v, 359. Boston: Little, Brown and Company, 1927.

It is only seldom that the vituperative pen of a college professor creates the commotion which was aroused in financial and official circles by the publication of the series of articles on corporate practices which first appeared in the *Atlantic Monthly* and which were subsequently expanded into the present volume. Members of the New York Stock Exchange literally "sat up and took notice." The Interstate Commerce Commission, in several of its recent decisions, has heeded the note of warning sounded by Professor Ripley, while the Committee on Industrial Securities of the Investment Bankers Association of America

has publicly expressed its disapproval of some of the corporate machinations elucidated so forcefully in *Main Street and Wall Street*. In the words of the author "such immediate and well-nigh unanimous response to but a slight stimulus is perhaps unique in our economic annals." It reflects not only a growing consciousness of the existence of unsocial tendencies in modern corporate activity, but more interestingly reveals the fact that the modern college professor can and does at times step out of his proverbial rôle of groping abstract theorist to hold up the mirror to the grim realities of life.

*Main Street and Wall Street* makes decidedly entertaining as well as profoundly instructive reading. Even though we may be inclined to minimize the importance of voting rights to the average stockholder and to deprecate the significance of divesting ownership from control in modern corporate procedure, the fact remains that the author has rendered a very timely service by inquiring "deeply concerning those things which might better serve the common good than is now the case."

KARL SCHOLZ.

TARDIEU, ANDRÉ. *France and America: Some Experiences in Coöperation*. Pp. viii, 312. Price, \$3.00. Boston and New York: Houghton Mifflin Company.

M. Tardieu, in this excellently written book, presents a picture of the relationship that has existed between his country and America since its founding. Remarkably unbiased in his point of view, he applies to the problem his extensive knowledge of American political and social institutions and habits of mind. He shows clearly, insistently, that the two races, so opposite in historic traditions, in ideas of government, in temperament, have much to offer each other in the way of mutual help and understanding. The problem of tomorrow, he says, is the proper ordering of Franco-American friendship that it may be fruitful.

The war brought into close contact two countries that are potential enemies; since 1918, however, the gap has again widened rather than lessened. France, concedes Tardieu, has as frequently taken the wrong course in her dealings as has the United



States. It is necessary that she borrow some of America's optimism, that she group her forces rather than her weaknesses, that she put herself on a footing of equality with the United States. America, on the other hand, must become more human, must cultivate greater commercial tact, must commit fewer errors of judgment and action. Each country must learn to know the other better.

The book is conceived along optimistic lines. Tardieu is convinced by reason and by experience of the coming enlightenment for which he pleads.

DOUGLAS L. HUNT.

SAIT, EDWARD M. *American Parties and Elections*. Pp. vii, 608. New York and London: The Century Company, 1927.

This book starts off with a discussion of manhood suffrage and registration, Negro suffrage in the South, woman suffrage, and organized groups and public opinion. The author justifies this on the basis of a statement that these are the instruments of the party. He then turns to the nature and history of parties, party organization, nominations, and finally again to elections. The text is replete with citations and numerous and pertinent quotations from the sources. The style is clear and interesting. The book is useful as a textbook for universities, but also as an interesting handbook for the many newer voters of the country who are anxious to learn the ways of politics and politicians.

CLYDE L. KING.

ENGELMANN, GEZA, PH.D. *Political Philosophy*. Pp. xxiv, 398. Price, \$3.00. New York and London: Harper and Brothers, 1927.

This is the translation of a book by this title written by the Hungarian scholar, Doctor Geza Engelmann. The translator is Doctor Karl Frederick Geiser, Professor of Political Science in Oberlin College. Introductory notes have been added written by Professor Oscar Jaszi, giving the background of the times in which each of these authors lived, with the exception that the introduction on Hamilton, Madison and Jay was written by Doctor Geiser.

This is not a résumé of the more im-

portant theories of the classical political scientists, nor is the book made up of excerpts of the original text with comments and footnotes. On the contrary, Doctor Engelmann presents what he finds to be the essence of the theories of fifteen of the greatest philosophers of the State. The leading and creative ideas of each philosopher are given. In his own footnote Doctor Engelmann said that his aim was "not to interpose my own ideas in a way that might seem inappropriate or disconcerting, but rather to arrange and formulate their thoughts clearly and concisely, as if the masters themselves were presenting, in a brief discourse, whatever in their teachings is of importance to us—their legacy to us."

The political scientists whose works are thus presented are Plato, Aristotle, St. Thomas Aquinas, Dante, Machiavelli, Thomas More, Thomas Hobbes, Baruch Spinoza, John Locke, Charles de Secondat, Baron de Montesquieu, Jean Jacques Rousseau, Alexander Hamilton, James Madison, John Jay, and Jeremy Bentham.

CLYDE L. KING.

OGBURN, W. F., and GOLDENWEISER, A. *The Social Sciences and Their Interrelations*. Pp. viii, 506. Price, \$3.50. Boston: Houghton Mifflin Company, 1927.

The development of specialized social sciences from "the metaphysical cradle of Mother Philosophy" has been accompanied by such an intellectual division of labor that synthesis as well as analysis has now become necessary. The student within a particular field becomes so engrossed with his specialty that its relationship to the general field of the other social sciences is apt to be obscured.

Although the task of an Aristotle, or even of a Herbert Spencer, in the synthesis of all knowledge seems difficult to imagine today, it does seem possible and desirable occasionally "to beat the boundaries" of the different social sciences and to glimpse as a whole the "no man's lands" of social science. To see the interrelationships of the different social sciences and to discover the effects of recent developments within each social science on all the others is the

ambitious purpose of this new book of Professors Ogburn and Goldenweiser.

The social sciences are divided into five grand divisions. In the first portion of the book the relationship of anthropology is traced to each of the other social sciences. Then follow, in turn, discussions of the relationship of economics, of history, of political science and of sociology to each of the other social sciences. There is an introductory chapter on the general field of the social sciences and a concluding section on the relations of the social sciences in general to such allied fields as biology, education, the natural sciences and philosophy.

As each chapter is written by a different author, some duplication and a lack of continuity are inevitable. Moreover, there are certain apparent differences in method of treatment and in the value of the various contributions. Again, the editorial pressure to compress within one small book this enormous field has resulted in many brief statements, which call for expansion, and certain general statements, which require further explanation.

The reviewer would not presume to pass on the "correctness" of the divergent points of view of the numerous authorities in these many divergent fields. Such a clash of opinion is to be desired as well as to be expected. Therein lies one of the chief merits of the book.

The authors of the different chapters are leaders within their respective fields. The editors are to be congratulated on having secured the coöperation of such a group of social scientists. The national and international reputations of the contributors to this volume make it deserving of the study of all teachers and advanced students of the social sciences.

*The Social Sciences* may perhaps be described as an orientation textbook for all graduate students in the social sciences. Although open to many criticisms—chief of which is that it has attempted the impossible—this book makes a real contribution in itself, as well as pointing the way toward a more comprehensive and intensive synthesis of the social sciences.

S. HOWARD PATTERSON.

KILBORNE, RUSSEL DONALD. *Principles of Money and Banking*. Pp. vii, 559. Price, \$4.00. Chicago: A. W. Shaw Co., 1927.

Professor Kilborne has in a single volume essayed to cover an extensive field. The book is divided into four parts, one on Money, another on Foreign Exchange, another on Commercial Banking and the Federal Reserve System, another on Non-Commercial Banking. Under the last heading there are chapters on Trust Companies, Savings Banks, Investment Banks, Investment Trusts, the Federal Farm Loan System, and the Federal Intermediate Credit System. The broad scope of the work leads to its chief defect. To compress his material within the limits designed, Professor Kilborne has been forced apparently into a rather didactic treatment. Principles are set forth without sufficient demonstration to make them entirely clear, and occasionally controversial matter is presented in a positive way as though it were a statement of fact. For example, on page 93, "While the national banks are still allowed to issue notes, the issue function will within a short time be granted only to the Federal Reserve Banks." No doubt that is the hope of most students of currency problems; it may even be highly probable, but whether it will occur within a short time depends upon the action of the government when the bonds securing the currency mature.

The author explains his method of treatment by pointing out in his preface that he is emphasizing fundamentals and principles rather than facts and structure. Although the work contains no original contribution to monetary and banking theory, it is clearly written and its subject matter is logically developed. It should be of value to those who desire to obtain a general picture of a broad field without delving deeply into any part of it.

W. CARLTON HARRIS.

GARIS, ROY L. *Immigration Restriction*. Pp. xv, 376. Price, \$4.00. New York: The Macmillan Co., 1927.

Professor Garis has attempted a history of the development of "the opposition to

and the regulation of immigration into the United States." It was not his purpose, however, "to judge the merit and truthfulness of the causes of the opposition and legislation" (p. xi).

This is to be regretted, for throughout the study he gives the impression of taking the position that any sort of restriction legislation is better than none. It would seem that in a history the author should refrain from constantly praising any given policy unless sufficient evidence is included in support of such an attitude. There is no adequate analysis of the economic, social or biological effects of immigration, yet there is assumed an urgent need for legislation to prevent the immigrant from swamping our industries, disrupting our government, filling our jails, hospitals and almshouses and lowering the biological qualities of our population. Perhaps the writer's approach is in a way indicated by an isolated illustration. In partial support of his statement that "For America, the Japanese are a nonassimilable people, as are all Asiatics . . .," he quotes the two lines from Kipling beginning "East is East . . ." (p. 353).

In spite of this bias, *Immigration Restriction* is a most valuable study. The development of the restrictionist policy (as a restrictionist sees it) from Colonial times to the present is clearly presented though much is necessarily omitted. All important immigration legislation is admirably summarized. Special chapters deal with Chinese and Japanese immigration. The brief foreword by the Honorable Albert Johnson, Chairman, Committee on Immigration and Naturalization, House of Representatives, whose immigration policies are well known, strikes the keynote for the volume.

DONALD YOUNG.

McCOMBS, CARL E. *City Health Administration*. Pp. 524. New York: The Macmillan Company, 1927.

The author, in the preparation of this volume, has aimed to present a non-technical treatise on municipal health administration. An introductory section considers, first, the place of municipal health service in the field of public welfare, and, second,

the administrative relations of the preventive and curative health functions. Great emphasis is placed upon the advantages to be derived from the consolidation of all health and welfare functions in a single department with a competent administrative head. A second section, comprising fully two-thirds of the volume, deals with the organization and administration of sickness preventive functions, certainly the larger and more important aspect of the municipal health service. Subjects under this section which chiefly engage the attention of the writer are the problems of personnel, functional organization, vital statistics, food and sanitary inspection, health education, and finance. A final section, dealing with the organization and administration of sickness treatment functions, analyzes numerous problems arising in connection with municipal hospital service.

Dr. McCombs has rendered a valuable service in making available the results of numerous municipal health surveys. The work is comprehensive and authoritative. The author's wide experience, which has brought him into close contact with actual situations, militates against any tendency on his part to become dogmatic in his discussion of principles. There can be little question but that this is the best treatment of municipal health service in the United States that has as yet appeared. The volume contains an excellent bibliographical accompaniment.

MARTIN L. FAUST.

YOUNG, ALLYN A. *Industrial Combinations and Public Policy*. Pp. 331. Price, \$2.50. New York: Houghton Mifflin Co., 1927.

This book dealing with one of the most important of modern economic problems is equally well suited for use as a text for courses in Trusts and Monopolies and for the purposes of the general reader. The book meets the claims made for it in the Editor's Introduction, where it says that "the tone of the book throughout is that of thoughtful and candid discussion."

In his treatment of the subject, *Industrial Combinations and Public Policy*, the author gives the combination movement its his-

torical setting; analyzes its general economic aspects; appraises carefully the results of combinations in a number of important industries; and then at the end there is a judicious balancing of the various considerations that help to determine what public policy should be. There are different types of industries, however, and no single system of control will work well throughout the whole field. The criteria which set apart the different types of industry are examined, and reasoned conclusions are reached with respect to the method of control which appears to be best adapted to each type.

W. C. PLUMMER.

WELD, W. E., and TOSTLEBE, A. S. *A Case Book for Economics*. Pp. xiii, 508. Boston: Ginn and Company, 1927.

VANDERBLUE, H. B. *Economic Principles: A Case Book*. Pp. xvii, 670. Chicago: A. W. Shaw Company, 1927.

New college texts in economics have been numerous, but real pioneers have been rare. There are many texts on economic principles, on economic problems, and on economic principles and problems combined. There are also several collections of readings in economics and also several excellent books of questions and exercises based on various standard texts. But an unfilled need, often expressed at meetings of the American Economic Association, has been for a case book for teachers of economics who desire to follow this particular method of presentation. At last, the tools for teaching economics by the case method have been provided by the publication of the two books under review.

After an examination of these excellent texts of Professor Vanderblue and of Professors Weld and Tostlebe, the reviewer is still uncertain as to just what constitutes a case book in economics. How does it differ from a live book of readings, well selected, carefully pointed toward certain educational objectives and with leading questions appended to each selection? Although there are many first-hand cases taken from actual industry, which give these books a realistic flavor, there are also many mere descriptions which differ little from those found in a good book of

readings. Indeed, the first "case" in Professor Vanderblue's book is the classical illustration of division of labor, which is taken from Adam Smith's famous picture of the manufacture of pins. Although the reviewer knows of no better description of division of labor than that of Adam Smith, does this constitute a "case"?

The case book of Professor Vanderblue seems more adapted to the needs of advanced students, and that of Professors Weld and Tostlebe more suitable for less advanced students of economics. Again, the arrangement of Professor Vanderblue's book seems more logical. At least, it conforms more nearly to the generally accepted plan of organization. It follows rigorously that of Professor Taussig, and the assumption is that the student will read the corresponding chapters of the latter's "Principles of Economics." Nevertheless, each chapter of Professor Vanderblue's case book contains specific references to most of the other standard texts on economic principles. It is also well indexed and contains an appendix consisting of an alphabetical list of cases in addition to the logical enumeration of cases contained in the table of contents. On the other hand, the case book of Professors Weld and Tostlebe contains neither an index nor references to general texts on economics. The suggestion is made that, "The cases may be used in any convenient order and with any of the textbooks."

It is not part of the reviewer's task to discuss the advantages and disadvantages of teaching economics by the case method, which has long been the favorite method of teaching law. It is merely his pleasant function to announce that there are now available in book form materials for the teaching of economics by this method. Actual classroom experience alone will demonstrate the possibilities and limitations of teaching economics by the case method.

S. HOWARD PATTERSON.

BECKER, CARL. *Our Great Experiment in Democracy*. Price, \$3.00. Pp. ix, 332. New York and London: Harper and Brothers.

This is a reprint, with slight revisions, of the author's "The United States: An Ex-



periment in Democracy," first printed in 1920. The book deals in a most interesting fashion with America and democracy, the origins of democracy in America, the new world experiment in democracy, democracy and government, new world democracy and old world intervention, democracy and free land, democracy and slavery, democracy and immigration, democracy and education, and democracy and equality.

What the author of the book calls the publisher's "blurb" on the jacket in which the publisher says that the book gives "a clear, honest, and brilliant picture of the United States as a democracy from the first Continental Congress down to the Harding Administration" is a fair statement of the style and contents of the book. The point of view of the book is expressed in the following quotation: "Political democracy we have; but the old economic democracy is rapidly becoming a thing of the past. To achieve, under these changed conditions and by new methods, the economic freedom without which political freedom is of little use is the task of the coming years."

CLYDE L. KING.

CLEVELAND, FREDERICK A. *American Citizenship as Distinguished from Alien Status*. Pp. 464. Price, \$4.00. New York: The Ronald Press, 1927.

This volume appears as the first of a series to be published by the Department of Citizenship of Boston University in partial fulfillment of the University's obligation under the Maxwell Foundation. The purpose of this book, as stated by Doctor Cleveland, is to set forth what the citizen's relation is to the community by means of a scientific presentation of the facts which it is thought each American citizen and each "stranger within our gates" should know about his status. The twenty-one chapters into which the development of the subject is divided are grouped under the heads of "Citizens as Members of Political Society," "Citizens and Aliens as Beneficiaries," and "Citizens and Aliens as Subjects." Three chapters, VIII, IX, and X, are acknowledged as comprising substantially the same material as was submitted for a Master's degree thesis by an associate in the Department of Citizenship.

While Doctor Cleveland states in his preface that the volume "undertakes to set forth in clear and orderly terms the meaning and implications of American Citizenship as defined in the constitutions of the nation and the states, in statutes, the decisions of courts, and the utterances of government officials," he proceeds to ignore official documents almost entirely and to assemble his facts for this undertaking to a great extent from secondary sources, frequently in the form of lengthy quotations and very unfortunately, in several instances, from works which have been rendered out of date by recent constitutional or statutory changes. An error such as appears in the direct quotation on page 167, where nine states are mentioned as granting suffrage rights to aliens who have declared their intention to become citizens, is due to the fact that the quotation is taken from a work published in 1914. But no such obvious reason is apparent for the error on page 57 where it is stated that naturalization can be administered by United States courts only.

The latter part of the book (Part III) is by far the best. Chapter XIV, "American Conceptions of Sovereignty," and Chapter XVII, "Individual Liberty and Authority," are especially stimulating. The extensive bibliography and the thirty-seven pages of Questionnaire and References to Special Readings, add considerably to the value of the book.

J. TANGER.

PATTERSON, EDWIN WILHITE. *The Insurance Commissioner in the United States: A Study in Administrative Law and Practice*. Pp. xviii, 589. Price, \$6.00. Cambridge: Harvard University Press, 1927.

This volume is the first of a new series of Harvard Studies in Administrative Law. It is a remarkably able summary and criticism of the forty-eight state departments of insurance based on an exhaustive study of statutory enactments, judicial decisions, departmental rulings and actual practice. The organization, personnel, functions, scope of administrative control, methods of control and amenability to external control of the state departments of insurance are

considered in order.

Professor Patterson presents a clear-cut study of one of the most outstanding recent developments in American legal history, namely, the application and enforcement of law through administrative agencies rather than through the ordinary courts.

I. L. POLLOCK.

BEELEY, ARTHUR LAWTON. *The Bail System in Chicago*. Pp. 189. Price, \$2.00. Chicago: University of Chicago Press, 1927.

This is a social service monograph recording the results of a pioneer study of the question of bail, with the main idea in mind of discovering a method for predicting the moral risk involved in releasing an accused person without bail pending trial. This investigation will impress the reader as presenting some original and helpful ideas for the improvement of minor and major courts, especially the substitution of the summons for the warrant of summary arrest in all cases where the accused is reasonably sure to appear for trial, and the extension of the Juvenile Court jurisdiction to all persons nineteen years of age or under.

EDWIN O. LEWIS.

FRANKLIN, FABIAN. *The ABC of Prohibition*. Pp. 150. Price, \$1.00. New York: Harcourt, Brace and Company, 1927.

This little volume does not purport to be any exhaustive analysis of the prohibition problem, but is merely, as its title suggests, a review of the outstanding features of the question. Mr. Franklin is a philosophical anti-Prohibitionist, and he confines himself almost entirely to a statement of general principles against the Eighteenth Amendment. He admits the inadequacy and ambiguity of statistics, and makes only very slight use of them. He is surprisingly candid and liberal toward the Prohibitionists, although it must be said, I think, that in connection with the reasons for prohibition and the causes of crime he does not say all that might be said for his opponents.

J. H. LEEK.

SEARS, MARTIN. *A History of American Foreign Relations*. Pp. 648. Thomas Y Crowell.

This excellent book of Dr. Sears meets a long-standing need in the literature of American foreign policy. Without attempting to enter into too great detail, the author has given a comprehensive and at the same time philosophic presentation of the development of American foreign policy. One cannot help but admire the self-control shown by Dr. Sears in eliminating the unessential and in confining himself to the basic influences that have determined the foreign policy of the United States.

In many respects, Dr. Sears' book is the most comprehensive text book on American foreign policy that has appeared. It is peculiarly well adapted to purposes of instruction in high schools and colleges and will serve to stimulate the broadening of instruction in this field in our secondary schools and colleges.

CHAPMAN and WESTERFIELD. *Problems in Banking, Money and Credit*. New York: The Ronald Press Company.

This book is designed to meet the vogue of the problem method. The subjects on which problems are presented run the gamut of the field of finance. While very suggestive, many of the problems are undeveloped.

GUEST, HAROLD W. *Public Expenditure*. Pp. xiv, 217. Price, \$1.75. New York-London: G. P. Putnam's Sons, 1927.

This book is entitled *Public Expenditure*. The subtitle is "The Present Ills and the Proposed Remedies." One chapter of the book is devoted to the growth of public expenditures, a total of about twenty pages. There is nothing new in the analyses of the figures of this chapter. The remaining two hundred pages are devoted to a rehash of modern social psychology and of some of the classical theories of public finance.

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**GREAT BRITAIN'S RECENT  
TREND TOWARD PROTECTION**

By  
**RALPH A. YOUNG**  
Instructor in Economics  
University of Pennsylvania

1. The first part of the book is devoted to a general  
introduction of the subject. It contains a brief  
history of the subject and a statement of the  
object of the book. The second part of the book  
is devoted to a detailed treatment of the  
subject. It contains a number of chapters, each  
dealing with a different aspect of the subject.

## CHAPTER I

The first part of the book is devoted to a general  
introduction of the subject. It contains a brief  
history of the subject and a statement of the  
object of the book. The second part of the book  
is devoted to a detailed treatment of the  
subject. It contains a number of chapters, each  
dealing with a different aspect of the subject.



## FOREWORD

GREAT BRITAIN has in recent years abandoned the principle of a "tariff for revenue only" as the all-inclusive formula underlying her national fiscal policy. Such a conclusion is supported by the facts which have been assembled in the following study. For many decades ardent believers in free trade, the British have finally succumbed to pressure for modifications along protectionist lines. In a period when world commerce has been expanding to an extent never before experienced, the multiplication of trade barriers presents a serious problem. The application of tariffs menaces and even hinders the continued growth of economic interdependence. This shift in British policy, therefore, is of utmost interest and significance.

It is hoped that the explanation of Great Britain's present tariff position offered in the succeeding pages will assist the reader in understanding her change of system. Such an understanding requires some familiarity with the history of British free trade because the roots of the movement lie in the past. The first chapter, accordingly, contains a brief review of developments prior to the war. The next two chapters trace the trend to the time of writing. Subsequent chapters include an analysis of the various economic forces tending to effect an alteration in the fiscal policy, while the final chapter is given to summary and conclusion.

RALPH A. YOUNG

The first of these is the fact that the  
 world is not a uniform whole, but a  
 collection of many different parts, each  
 with its own characteristics and laws.  
 The second is the fact that the world is  
 not a static whole, but a dynamic whole,  
 constantly changing and evolving.  
 The third is the fact that the world is  
 not a simple whole, but a complex whole,  
 with many different levels of organization.  
 The fourth is the fact that the world is  
 not a single whole, but a many-whole,  
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# Great Britain's Recent Trend Toward Protection

## CHAPTER I

### FREE TRADE IN GREAT BRITAIN PRIOR TO 1914

IN January, 1846, came the culmination of long political strife over the tariff issue in the repeal of the Corn Laws. Subsequent years witnessed the vestiges of the old tariff system gradually destroyed. By 1860, the year of Cobden's famous Anglo-French commercial treaty, just forty-eight dutiable articles remained in the tariff schedule and only fifteen of these contributed to revenue.<sup>1</sup> From this date on until 1914, the British tariff schedule was characterized by an absence of duties for other than revenue purposes. The expression, "free trade," became literally descriptive of the British fiscal policy in this era. While free trade was in the ascendancy, tending each decade to become more thoroughly institutionalized, there were, now and again, outbreaks of public opinion from interested quarters demanding an active protectionist tariff policy. From 1900 to 1914, such a movement attained considerable momentum, culminating in the commitment of the Conservative Party to a program of tariff reconstruction, while the Liberal Party remained staunch protagonists of the historic policy of free trade.

The story of the struggle over the fiscal policy during this period holds important source material for such a study as the present one. It is not our task, however, to write a history of the British fiscal-economic policy of tariff for revenue only. We are interested

primarily in recent developments. Nevertheless, since some familiarity with the earlier story is indispensable to an understanding of the present trend, it is desirable to point out in review what seem to be the most significant aspects of the pre-war trend. Our review will be a summary rather than a detailed account.

#### FREE TRADE AND THE FLOWERING OF BRITISH INDUSTRY

Far-reaching reorganization of British industrial life had been the result of the industrial revolution. The new technique of production acquired therefrom provided the capacity for a tremendous expansion of trade. A large foreign market anxious to accept British products in exchange for raw materials and foods stimulated the industrial processes and hastened the full development of the British industrial system. A combination of circumstances, climate, resources, population, creative energy and trading experience enabled Great Britain to utilize effectively the new methods of intensive production. Although population underwent a growth of, roughly, 60 per cent from 1801 to 1851, British export figures, with allowances made for price changes, show an increment of 100 per cent from 1805 to 1840, and about 90 per cent in the next ten years, or a growth of almost 400 per cent for the entire fifty-year period. Real exports of British produce, therefore, were increasing up to 1840 at a slightly greater

<sup>1</sup> Hirst, F. W., *From Adam Smith to Phillip Snowden* (Unwin, London, 1925), p. 41.

rate than population, and after that date, at a much greater rate.

For twenty years after 1850 British trade continued to advance with great strides. A superficial observer might account for this by citing the repeal of the Corn Laws and the inauguration of a free trade fiscal policy, but many other factors contributed, among them, the extensive discovery of gold in this period;<sup>2</sup> the growth of railroad and steamship transportation; the rapid expansion of other human wants, satisfied by machine production, and England's early start in this field; the freedom of British trade from the disturbance of war and the foreign demand for her products stimulated by the American Civil War, Austro-Prussian War and Franco-Prussian War;<sup>3</sup> and finally, the reaction against extreme tariff barriers abroad and the extension of the "most-favored nation" privilege through treaties.<sup>4</sup> Other considerations, too, doubtless contributed to Great Britain's rise to dominant power in the field of foreign trade. This phenomenon, it should be recognized constantly, was the result of an inextricably complex mass of forces.

Succeeding the era of unprecedented prosperity was a period fraught with problems which brought the question of protection once more to the fore. The year 1868 witnessed the most serious industrial and trade depression experienced since the adoption of a free import policy. In this year a "Revivers of Trade Association," organized for the purpose of advocating reciprocity or retaliation against those countries erecting harmful tariff barriers, carried the question before the

public.<sup>5</sup> Although the movement died down when trade momentarily revived from 1870 to 1873, interest was re-suscitated in the succeeding year. To this flame was added the fuel of sugar bounties on the continent and the denouncement of the Anglo-French commercial treaty by France. Finally, in July, 1861, a new organization, composed of a number of manufacturers drawn together by the continued depression, was called into being under the title, "National Fair Trade League," which advocated a comprehensive change in the fiscal policy.<sup>6</sup>

The new movement quickly aroused interest, and in the depression during the middle of the eighties, assumed large proportions.<sup>7</sup> The fact that most European countries of importance, France, Italy, Germany, Austria and Russia, were in the process of increasing their duties, incited further agitation.<sup>8</sup> Proposals favorable to increased tariffs were advanced in Parliament. Moreover, the Minority Report of the Royal Commission to inquire into the causes of commercial and industrial depression, based its conclusions throughout upon a point of view similar to that of the "fair traders." The movement reached a climax in 1887, when, at a Congress of the Conservative Association held at Oxford, a resolution was passed unanimously in favor of "fair trade." This action forced Lord Salisbury, then Prime Minister, into a position which he had formerly hesitated to assume, because of the necessity of Conservative support. In 1887, however, trade suddenly recovered and the issue disappeared. Although it revived again with the passage of the McKinley

<sup>2</sup> Mr. Armitage Smith quoted by Drage, G., *The Imperial Organization of Trade* (Smith-Elder, London, 1911), p. 24.

<sup>3</sup> Ashley, Sir William, *The Tariff Problem* (King, London, 1920), p. 54.

<sup>4</sup> *Ibid.*, p. 52.

<sup>5</sup> For an ample treatment of this movement see Fuchs, C. J., *The Trade Policy of Great Britain and Her Colonies Since 1860* (Macmillan, London, 1905), pp. 188-92.

<sup>6</sup> *Ibid.*, pp. 194-6.

<sup>7</sup> *Ibid.*, pp. 196-201.

<sup>8</sup> See also Drage, *op. cit.*, p. 124.



Tariff in the United States, neither party was willing to adopt "fair trade" as part of its platform.

#### THE ORIGIN AND SPREAD OF COLONIAL PROTECTIVE TARIFFS

Prior to and including the period which has just been traced, Great Britain's attitude toward her colonies had been curiously apathetic.<sup>9</sup> Not since the last of the eighteenth century had more than indifferent attention been directed to their affairs. As a matter of recorded fact, many statesmen manifested a willingness, even a desire, to abandon them altogether as unprofitable.<sup>10</sup> Parliament was neglectful of their welfare, while public interest could be diverted from problems of proximate interest to the remote questions of colonial concern only on extraordinary occasions.<sup>11</sup> It was commonly expected by some that the colonies would sooner or later secede from the Empire.<sup>12</sup> Doubt as to their commercial value was also prevalent, particularly at the cost of eternal coercion and struggle. Self-government grants, consequently, were readily assented to by Parliament; and, save in the case of the Australian Enabling Act of 1850, there were no legal restrictions placed upon the tariff enactments by the self-governing dominions.<sup>13</sup> Evidently, the possibility of colonial tariffs was not considered seriously by British leaders.

It was not long, however, before the growing spirit of independence among the more aggressive colonies resulted in tariff legislation. A tariff act passed by the legislature of the United Prov-

inces of Upper and Lower Canada went into effect in 1858, and was the logical result of her freedom to control her own affairs. A second act was passed in 1859, despite futile protests from interested British business groups,<sup>14</sup> and the free trade propaganda of the Colonial Office. Other colonies were shortly engaged in the process of tariff building. In 1871, after a short struggle with the British Colonial Office and Parliament, the Australian colonies succeeded in establishing tariff laws.<sup>15</sup> In South Africa, a gradual recognition of a community of commercial interests finally bound the various colonies into a customs union (1889), lacking only the coöperation of Transvaal and Natal, the latter joining in 1898.<sup>16</sup> "One after another," writes Mr. E. Porritt of this movement, "their legislatures enacted tariffs with comparatively high protectionist duties, duties that until 1897 were imposed alike on manufactures of British or non-British countries."<sup>17</sup> The confident expectation that free trade would become the established commercial policy of the Empire, which prevailed in Downing Street at the time when the old system was finally destroyed, thus, failed to be realized.<sup>18</sup>

#### THE EARLY COLONIAL CONFERENCES AND THE MOVEMENT FOR IMPERIAL PREFERENCE

Toward the end of the century, British manufacturers became accustomed to the tariff barriers imposed by the colonies and protests against trade obstacles practically ceased.<sup>19</sup> A new attitude toward the colonies was rapidly developing. More and more,

<sup>9</sup> See Mr. E. Porritt's exhaustive study on this question, *The Fiscal and Diplomatic Freedom of the British Overseas Dominions* (Clarendon Press, Oxford, 1922), Parts V and VI, pp. 283-397.

<sup>10</sup> *Ibid.*, pp. 296-399.

<sup>11</sup> *Ibid.*, pp. 323-99.

<sup>12</sup> *Ibid.*

<sup>13</sup> *Ibid.*, pp. 61-9.

<sup>14</sup> *Ibid.*, pp. 41, 85, 98 and 384-5.

<sup>15</sup> *Ibid.*, p. 100.

<sup>16</sup> Bruwer, A. J., *Protection in South Africa* (Univ. of Penna., Doctoral Dissertation, Philadelphia, 1923), pp. 67-107.

<sup>17</sup> Porritt, *op. cit.*, p. 66.

<sup>18</sup> *Ibid.*, p. 67.

<sup>19</sup> *Ibid.*, pp. 400-1.

investments in colonial undertakings were absorbed by the London financial market. Emigration to the colonies steadily increased. Educational work by the Royal Colonial Institute and the propaganda of the Imperial Federation League contributed to the awakening of popular interest. Still further attention was attracted to the colonies by the fact of renewed colonial expansion on the part of other European governments, and by the growth of tariff barriers on the continent.

Lord Salisbury, the Prime Minister, being sympathetic toward this general interest, and urged by a deputation of the Imperial Federation League, called a meeting of colonial representatives for an interchange of knowledge.<sup>20</sup> Subjects of Imperial defense, and the promotion of commercial and social relations were scheduled to be discussed. Representation was to be quasi-official only. Thus was planned an organization destined to become of great significance as a medium through which Empire interests could be advanced. By means of it was made possible a new sort of Imperial political pressure which was to have an important influence over future British policies. Of the subtle forces tending to shift Great Britain's traditional free trade policy, perhaps there is none more important than the Imperial and Colonial Conferences. At least, we find in them the initial pressure for the Imperial preference movement which has come to play such a heavy rôle in the construction of all Empire tariff schedules.

The 1887 Conference, being purely informal, could pass no resolutions upon subjects discussed. It is a safe observation to make, nevertheless, that, had there been, foremost among them would have been a vigorous one

in favor of an Imperial preference tariff system. Enthusiasm waxed strong from the introduction of the subject, even though the Canadian delegates were non-committal and the attitude of the Victorian representatives was tinged with scepticism.<sup>21</sup>

The "seed of ideas which had been sown in 1887" proceeded to germinate in the various colonies. In Canada, particularly, the issue came to a head over the proposal for unrestricted reciprocity with the United States, as against closer union with the Empire.<sup>22</sup> As a result of this struggle, Canada petitioned the Crown requesting the termination of the treaties with Belgium and Germany, which forbade the British colonies from levying higher duties on the imports of those countries than on corresponding imports from Great Britain. It was entreated further, that, in the future, no commercial treaty should be made binding on any colonial government without its express consent. Thus, the attitude of Canada on preference finally was made definite; she required either a position where she could take advantage of her membership in the Empire, or else she desired to go her own way as an independent nation.

In view of this, when, through Canadian efforts, the Colonial Conference of 1894 met at Ottawa, it was natural that discussion should center on the general question of Empire trade, although the ostensible purpose of the Conference was much narrower; i.e., the consideration of trade relations between Canada and Australia and the promotion of the Pacific cable.<sup>23</sup> Out

<sup>20</sup> Sir Samuel Griffith, Prime Minister of Queensland, introduced the subject and was ardently supported by Mr. Joseph Hofmeyer, of Cape Colony. See either *Ibid.*, pp. 64-77, or *Proceedings of the Colonial Conference, 1887* (C. 5091), pp. 462-3 and 463-8.

<sup>21</sup> Jebb, *op. cit.*, p. 165-6.

<sup>22</sup> *Ibid.*, p. 167.

<sup>23</sup> Jebb, R., *Imperial Conferences* (Longmans-Green, London, 1911), Vol. I, pp. 7-9.

of the discussion came two resolutions, "speedily and unanimously passed," requesting the Imperial Government to take steps to terminate existing treaties which operated to prevent tariff preferences among the colonies; and also to pass legislation enabling the dependencies of the Empire to enter into agreements of commercial reciprocity.<sup>24</sup> Other resolutions affirmed the "practical possibility" and even the "advisability" of an Imperial fiscal system.<sup>25</sup>

MR. JOSEPH CHAMBERLAIN AND THE  
COLONIAL CONFERENCES OF 1897  
AND 1902

Shortly after the events just narrated, Lord Salisbury returned to power, and Mr. Joseph Chamberlain, a prominent Conservative statesman with a pronounced imperialistic bias, chose the portfolio of the Colonial Secretary as his part in the new Government, even though this office had been deemed of secondary importance hitherto. Mr. Chamberlain had taken considerable interest in colonial development, and believed that the British Government should take every advantage to bind the colonies to the Crown, even with the view of ultimate

federation.<sup>26</sup> The establishment of commercial union he considered to be the first step. Consequently, little surprise was evinced when he threw open the Conference of 1897 to an unreserved discussion of the question of Imperial trade relations. Nor, further, when he advised the Conference that, if it thought wise, the Crown would consider the termination of the Belgian and German treaties.<sup>27</sup> Resolutions passed by the visiting Premiers agreed to consider with their governments the problem of preference, and requested the British Government to terminate the above-mentioned treaties.<sup>28</sup>

The response of the Crown to their wishes with respect to the treaties was immediate, for it was shortly made public that they had been officially abrogated.<sup>29</sup> It was stated further that, after July 30, 1898, nothing would remain in any of Great Britain's treaties to stand in the way of preference grants on the part of the colonies in favor of United Kingdom produce. With this announcement was also a warning regarding the possible extension of the "most-favored nation" clause in the event of preference grants to foreign nations. The Colonial Premiers were thus able to return to their respective legislatures with a distinct concession from the mother country. The Colonial Secretary, while wholly sympathetic, made it clear, however, that, whether or not there could ever exist sufficient political demand for preference in Great Britain, must depend largely on the colonies and the effective demands of their citizens.

It is doubtless true that there was little enthusiasm of a popular nature in many colonies. In Canada, where

<sup>24</sup> Jebb, *op. cit.*, pp. 167-71.

<sup>25</sup> *Ibid.*, pp. 172-88. It is interesting to note, in this connection that Lord Jersey, the British representative, although not a supporter of the Liberal Government which sent him, stated in his report to the Colonial Office that sentiment alone could never hold together the British Empire, and suggested that the solution lay in Britain's power to change the course of trade in such a way as to bind the colonies to her. Lord Rippon, the Colonial Secretary, cautiously and firmly replied to this report and to the Conference resolutions with a careful exposition of the principles of free trade, and with a statement that the Government could not terminate its treaties with Belgium and Germany. Full fiscal liberty, however, was granted by the Crown to the Australasian colonies (Canada and South Africa already possessing it). *Ibid.*, pp. 231-7.

<sup>26</sup> *Ibid.*, pp. 303-11.

<sup>27</sup> *Proceedings of the Colonial Conference, 1897* (C. 8596), pp. 10-11.

<sup>28</sup> *Ibid.*, pp. 14-5.

<sup>29</sup> *Ibid.*, p. 15.

preference had been granted just before the Conference, there may have been more than elsewhere. In South Africa and Australasia other issues were paramount. The insignificance of preference as a popular political issue is confirmed by the fact that no further preferences were adopted by any colony in compliance with the second resolution. Nor were any even seriously proposed. Meanwhile, the British Government itself was shortly engaged in the colonial war in South Africa.

New developments appeared in the 1902 Conference. Opened as it was by Mr. Chamberlain with a strong Imperial appeal, and the declaration that the demand for closer union could not originate with the mother country, the Conference delegates came forward with some definite offers for the preferential treatment of British goods.<sup>30</sup> In addition, the principle of reciprocal preference was affirmed in a group of strong resolutions, and the premiers were requested to take up necessary measures with their respective Governments.<sup>31</sup> Finally, Canadian delegates

presented a further memorandum to the Conference requesting the United Kingdom to reciprocate her preference grants by tariff exemptions on Canadian food, for which privilege she was ready to extend her existing preference allowance.<sup>32</sup> Moreover, the memorandum warned that if the Imperial Government rejected the principle, and if the principle were not acceptable to the other Colonial Governments, Canada would be forced to act as her interests dictated.

#### THE REVIVAL OF FISCAL CONTROVERSY AND THE CHAMBERLAIN CAMPAIGN

At that time, there existed in the British Budget certain duties on foreign corn and flour which had been established to raise revenue for the South African War. The Canadian Ministers had chosen a strategic moment to place their memorandum before the Imperial Government. Certainly the issue was clearly defined, whatever the value of the preferences offered. Such demands by the colonies were exactly what Mr. Chamberlain had announced to be the conditions necessary for his Government to consider seriously fiscal reform. When the British Government failed to take up the matter and the corn duties were repealed by the Budget in the following spring, colonial leaders probably were offended by what appeared to be "a slap in the face" from the professedly imperialistic party in Britain.<sup>33</sup> Mr. Chamberlain, while forced to drop his proposals temporarily, on May 15, 1903, brought the matter to the attention of his Birmingham constituents, reopening by this act, the "floodgates of controversy."<sup>34</sup>

<sup>30</sup> *Ibid.*, p. 36-8.

<sup>31</sup> Jebb, *op. cit.*, Vol. II, p. 45.

<sup>32</sup> In this connection, see Hewins, W. A. S., *Trade in the Balance* (Allan, London, 1924). Prof. Hewins was intimately associated with Mr. Chamberlain in this campaign as head of his Tariff Commission. He continues to be an advocate of tariff protection.

<sup>33</sup> See Mr. Chamberlain's opening address to the Conference. *Proceedings of the Colonial Conference, 1902* (Cd. 1299), pp. 5-7, or Jebb, *op. cit.*, pp. 352-7; and the preference offers of various colonies, *Conference Proceedings*, pp. 35-6, or Jebb, pp. 366-7. These latter are as follows:

*Canada.*—The existing preference of 33¼%, and an additional preference on lists of selected articles; (a) by further reducing the duties in favor of the United Kingdom; (b) by raising the duties against foreign imports; (c) by imposing duties on certain foreign imports now on the free list.

*Australia.*—Preferential treatment not yet defined as to nature and extent.

*New Zealand.*—A general preference by a 10% allaround reduction of the present duty on British manufactured goods, or an equivalent in respect of lists of selected articles on the lines proposed by Canada.

*The Cape Colony and Natal.*—A preference of 25% or its equivalent on dutiable goods other than specially rated articles, to be given by increasing the duties on foreign imports.

<sup>34</sup> *Conference Proceedings, op. cit.*, p. 36.



When the question came before the House of Commons, Mr. Balfour, the Prime Minister, declined to support unequivocally Mr. Chamberlain's proposals. He took a middle stand, however, acknowledging that the country was no longer in the position occupied by it when free trade was adopted, and admitting that a tariff might be useful for purposes of retaliation and bargaining. There was, perhaps, good basis for this position. Upon the continent had grown up a series of commercial treaties among protective countries, from which Great Britain had been excluded and which were due to expire about 1904 to 1906. The threat of a tariff might have regained a more favorable position for Great Britain among her rivals.

Rather than embarrass Mr. Balfour, under the circumstances, Mr. Chamberlain resigned from the Cabinet and gave himself to propagandizing for his cause.<sup>35</sup> Five other Ministers of free trade bias also resigned and the campaign began in earnest. The Tariff Reform League was organized at Birmingham, while the Tariff Commission originated by Mr. Chamberlain proceeded to draw up a "scientific" tariff. Mr. Chamberlain traveled over the country preaching the advantages of fiscal reform to local industries, and planning to force an election on the issue.<sup>36</sup> Mr. Balfour, however, managed to maintain such an even balance in his fiscal views that "each section of his party could interpret them in its own favor."<sup>37</sup> The election was delayed and the campaign went on, with the Free Trade Union and the Cobden Club

carrying on an extensive counter-propaganda.

The difficulties facing the Balfour Government during these years must have been very great. Chamberlain's efforts were splitting the party. Save for the fact that a party division at this time would have allowed the Liberals to come into power with their program of Irish Home Rule, there was little to hold the Unionist party together. A crisis finally came and Mr. Balfour tendered the resignation of his Ministry. In the general election which followed, free trade was the dominant issue. The Unionists met with overwhelming defeat, and the Liberal party came into power with Sir Henry Campbell-Bannerman at its head.

Although decisively defeated, tariff reform did not relinquish its place in the political arena. The Tariff Reform League continued its activities, as did likewise Mr. Chamberlain's Tariff Commission. Fuel was added to the controversy by the publication of a free trade memorandum on "The Fiscal Policy of International Trade," prepared by the late Professor Alfred Marshall, the eminent economist, as a Parliamentary Paper.<sup>38</sup>

Mr. Chamberlain, though forced by ill-health to retire from active participation, retained a lively interest in the problem. Mr. Balfour, finally converted to the former's ideas on fiscal reform, in 1909 declared himself a firm believer.<sup>39</sup> His new program advocated a duty on wheat, although he pledged that none would be levied on cotton and rubber. He argued further that tariff reform was essential to secure the home market from unfair

<sup>35</sup> For a short, vivid description of the campaign see Hirst, *op. cit.*, pp. 49-56.

<sup>36</sup> Hewins, *op. cit.*, p. 17. Mr. Hewins states that in October, 1903, some eminent opponents informed him that Chamberlain could carry the nation.

<sup>37</sup> Hirst, *op. cit.*, p. 54.

<sup>38</sup> While denying the need for tariff reform, Marshall did advocate the use of any and all financial weapons in reprisal against the refusal of the "most-favored nation" privilege to British trade. Parliamentary Papers, 1908, 321.

<sup>39</sup> Drage, *op. cit.*, pp. 155-6.



competition. The general election of 1909, which the Conservatives forced on the issue of Mr. Lloyd George's Budget, failed, however, to reseat them.

Shortly after the election, opposition developed to the leadership of Mr. Balfour, and, in November, 1911, he was supplanted by Mr. Bonar Law. The Unionist party now gave themselves to a complete scheme of protection and Imperial preference. Mr. Austen Chamberlain reported that the Conservative party proposed to put a 5 per cent duty on foreign foodstuffs and an average of 10 per cent on foreign manufactures. At the party meeting in November, 1912, a movement successfully took place to remove the referendum pledge of Mr. Balfour, which had promised to refer the principles of the tariff to a popular vote.<sup>40</sup> At the same meeting, Mr. Bonar Law declared that tariff reform was the party's most constructive plank, although food duties were involved. Later opposition which developed within the party forced the postponement of the proposal of food taxes.

This is the situation in which we find tariff reform just prior to the period of the War. The Conservative Party had committed itself irrevocably to tariff reconstruction, that is, as irrevocably as a political party can. Public interest in the question waned just before 1914 and was overshadowed by the problem of Ireland. As for industry and trade, since 1905, imports and exports had shown a lively upward trend. Dark forecasts about the retrogression and decline of Great Britain's trade no longer were capable of arousing great interest. Fiscal reform was in the background and destined to remain there until the exigency of a few and complex emergency should force it out.

<sup>40</sup> Hirst, *op. cit.*, pp. 58-

#### THE IMPERIAL CONFERENCES OF 1907 AND 1911

We are not ready to pass on to the developments of the War period until we have paused to consider the incidents of the two Imperial Conferences, as they came to be called, which took place in 1907 and 1911. The first, scheduled for 1906, was not held until the following year in order to allow the new Colonial Secretary, Lord Elgin, time for preparation. According to past custom, members were invited to submit subjects for discussion. The inevitable transpired; questions of preference and Imperial organization were among the most common ones presented.<sup>41</sup> It almost appeared that the Conference would "redound to the advantage of the opposition party, owing to the evident prominence of preference."<sup>42</sup> Its treatment in the Conference was characterized largely by debate, with the Liberal Ministers on the defensive before the British public with its divided sentiment. They were candid about having pledged themselves against "countenancing the smallest departure, no matter how trivial in itself, from the principles of the existing fiscal system."<sup>43</sup> Any concession to the Conference would have invalidated their platform and discredited them before the country.

Nevertheless, there were some significant offers made by Colonial Ministers. Although the proposal for an inter-colonial "most-favored nation" arrangement, introduced by Mr. Deakin, the Australian Premier, was quietly quashed, definite offers of additional preference for reciprocation on Great Britain's part were made by Australia, New Zealand and South Africa, while

<sup>41</sup> Jebb, *op. cit.*, Vol. II, pp. 27-32.

<sup>42</sup> *Ibid.*, pp. 64-5.

<sup>43</sup> *Ibid.*, pp. 181-7.

Newfoundland and Transvaal representatives agreed to subscribe to the 1902 resolutions.<sup>44</sup> Only the Indian representative opposed the idea.<sup>45</sup> The discussion ended by the passage of resolutions, of which the first, proposed by the Liberal Ministers, was simply a reaffirmation of the old principle of fiscal freedom, well-couched in diplomatic language, acknowledging the justice of permitting the special requirements and conditions of each member of the Empire to govern its contributions to Imperial commercial relations.<sup>46</sup> Two other motions, one of general nature and the other a strong reaffirmation of the 1902 resolutions were passed, the British ministers, of course, dissenting from the latter.<sup>47</sup>

In the 1911 Conference two steps were taken which may be regarded as victories for the Colonial delegates. The first was the acceptance by the Conference of a Canadian proposal that His Majesty's Government should open negotiations with several foreign governments in order to secure liberty for any of those who might choose to withdraw from the operation of certain commercial treaties.<sup>48</sup> No invalidation of the treaty regarding the rest of the Empire was desired. What was sought was such release from outside obligations as would enable the extension of intra-Empire preference arrangements, and also the privilege of the dominions to erect higher protective duties against whomever they desired. The Crown's acquiescence was merely a diplomatic step, for its acceptance contained the condition that

new treaties could be negotiated to replace existing ones, a condition which required the accession of the other parties, and was impossible of attainment.

The second resolution, passed unanimously, was by far the more significant.<sup>49</sup> It proposed a Royal Commission representing all sections of the Empire to investigate and report upon the natural resources of each part of the Empire, the facilities for production and trade, and the effect of existing commercial legislation. On the whole, such a resolution could cause the Liberal Government no embarrassment. Yet it may be considered a colonial victory because it committed the Liberal Ministers to a more decided Imperial policy than they had been willing to assume heretofore.

It is plainly very difficult to interpret the influence these Conferences may have had upon the Liberal Home Government. The 1907 Conference was its initial contact with that sort of political pressure. It is not unreasonable to suppose that an ineffaceable impression was made by a realization of the vast resources and population represented at the Conference table.<sup>50</sup> This impression may have prepared the way for its war-time protectionist compromise. Whatever the possibilities on that score may be, one thing only was certain, the Crown's position for the time on the question of trade relations with the colonies was clearly

<sup>44</sup> Likewise a Canadian suggestion offered as a compromise to a stronger Australian resolution reaffirming the 1902 preference resolutions, to which, of course, the Home Government could not assent. *Ibid.*, pp. 339-44.

<sup>50</sup> It is significant to note here that Mr. Richard Jebb, the authority on Imperial Conferences, observes a certain sympathy in Mr. Lloyd George's speeches to the preference idea and Imperial movement. Party obligations, asserts Mr. Jebb, prevented him from being more generous in his attitude. Mr. Jebb wrote in 1911. See his work, *Vol. II*, pp. 233-40.

<sup>44</sup> Jebb, *op. cit.*, Vol. II, pp. 187-218.

<sup>45</sup> He was a delegate from the Indian Office, rather than India, and a Liberal supporter, *ibid.*, pp. 219-22.

<sup>46</sup> *Proceedings of the Imperial Conference, 1907* (Cd. 3523), pp. 429-38.

<sup>47</sup> *Ibid.*, pp. 439-40 and 429.

<sup>48</sup> *Proceedings of the Imperial Conference, 1911* (Cd. 5745), pp. 333-9.

defined. It succeeded in checking effectively, though only temporarily, further advances toward preferential protection.

THE EXTENT OF PREFERENCE GRANTS  
BY THE SELF-GOVERNING DOMINIONS,  
1900 TO 1914

It is illuminating to note briefly, before leaving this period, the extent to which tariff preferences on British manufactures had come to be granted by the various colonies. Canada, for instance, had followed up her original preference grant of 1897 with an additional grant in 1900, extending to one third of the existing duties. Complaints from Canadian manufacturers brought a reduction in this preference in 1904.<sup>51</sup> In 1907, uniform percentage preference was abandoned, and specified preference rates were substituted showing variously a greater or less reduction than one third on British goods. In addition, an intermediate tariff for purposes of negotiation was adopted.

Following Canada's example in this respect, New Zealand, in 1903, added a surtax to certain imports, some thirty-eight items, from foreign countries.<sup>52</sup> This number was increased to one hundred and ninety-four in 1907. Under a reciprocity clause in the 1903 Act, she entered into a preferential arrangement with South Africa in 1906, but reached no other agreements either with foreign countries or other colonies.<sup>53</sup> In Australia, however, a preferential tariff did not make its appearance until 1908, although she entered into a reciprocal arrangement with South Africa two years before.<sup>54</sup> The basis of her tariff preference was, as with New

Zealand, protection of her own industries first. Consequently, preferences were created by increasing the duties on imports from other countries. Notwithstanding this, it was reported by the Dominions Royal Commission that throughout Australasia there existed a marked enthusiasm for the principle.<sup>55</sup>

South Africa, with her Customs Union and her tradition of protection might have been expected to enact a preference tariff at an early date. It was not accomplished, however, without overcoming some opposition, especially that of Cape Colony.<sup>56</sup> Only through the efforts of Lord Milner, His Majesty's High Commissioner in South Africa, and those of Mr. Chamberlain, was the preference promised at the 1902 Conference, enacted the following year.

The preferences granted by the colonies were unquestionably not large. Most of them were obtained by increasing the duties on foreign produce, colonial industry being amply protected against British products, though some British goods profited by them. Concerning the extent of their influence on Empire trade, there exists no barometer for measurement.<sup>57</sup> As to their effect upon the British fiscal policy, conclusions will be suggested later as the reader acquaints himself with

<sup>51</sup> Dominions Royal Commission, *Second Interim Report*, 1914 (Cd. 7210), p. 7.

<sup>52</sup> Bruwer, *op. cit.*, p. 122. The Premier of Cape Colony, however, favored preference at the Colonial Conference of 1902.

<sup>53</sup> The amounts of duty remittances or reductions by the various dominions for the few years prior to the War are suggestive. For example, they were, for Australia, in 1910, in thousand pounds sterling, 972; Canada, 1303; New Zealand, 536; South Africa, 594; and in 1913, for Australia, 1244; Canada, 1573; New Zealand, 760; and South Africa, 628. See in this connection the Dominions Royal Commission, *Second Interim Report*, 1914 (Cd. 7210), p. 7; *Fifth Interim Report*, 1917 (Cd. 8457), p. 7; *Third Interim Report*, 1914 (Cd. 7505), p. 7.

<sup>54</sup> Culbertson, W. S., *International Economic Policies* (Appleton, N. Y., 1925), pp. 161-2.

<sup>55</sup> *Ibid.*, pp. 170-1.

<sup>56</sup> *Ibid.*, p. 176.

<sup>57</sup> *Ibid.*, pp. 165-6.

further developments. Unquestionably, some pressure from colonial sources was being felt in Downing Street.

Our procedure up to this point has been to acquaint the reader, as briefly as possible and yet as exhaustively as space has permitted, with the immediate background of the British tariff problem, to the end that a more search-

ing survey of the recent trend toward protection may be made. The following chapter will treat the protectionist developments during the War, and the succeeding one will carry the study up to the present time. Subsequent chapters deal statistically with an analysis of British economic trends and their significance in explaining the late protectionist movement.

## CHAPTER II

### THE WORLD WAR AND PROTECTION IN GREAT BRITAIN

**F**OLLOWING the outbreak of the World War, the Asquith Liberal Government early faced difficulties with its program. Having failed to achieve any conspicuous military success, the Government found that political expediency made it necessary to take several Conservative leaders into the Cabinet. The object, it was averred, was to effect a national unity and unanimity, essential to a successful termination of the War. Domestic controversies, in the meanwhile, were to be placed, as Mr. F. W. Hirst states, "in cold storage." With a substantial majority in the House of Commons, and a War of unprecedented proportions going on, it did appear that the issue of protection and preference would be obscured.

Several circumstances operated to vitiate this possibility. In the first place, British industry was finding itself tremendously handicapped by the lack of certain essential products whose production was controlled by enemy interests. The military handicap of being so thoroughly a dependent industrial nation was forcefully brought to the attention of statesmen, officials and business men. In the second place,

there was an inevitable and universal realization of certain reputed economic designs of Germany which were said to be a part of her general war policy. Coupled with this was a growing fear that Germany was preparing to sweep down and destroy all Britain's industry and trade. Then there were the colonies which so patriotically had stood by the mother country in her emergency, placing the latter, however, in a position of very real obligation. Finally, certain problems of expediency arose necessitating fiscal action for temporary alleviation.

#### THE McKENNA DUTIES OF 1915

The first of the circumstances to be treated here belongs in the last of the above-named categories. In September, 1915, Mr. Reginald McKenna, the Chancellor of the Exchequer, proposed a startling innovation. His Budget contained a  $33\frac{1}{3}$  per cent duty upon a series of articles, including motor cars, motor cycles and parts thereof, cinema films, clocks, watches, musical instruments, plate glass and hats. He urged in his proposals that goods of such a nature should be taxed from the very outset in order to provide revenue and



to cut consumption which was deemed unnecessary. He denied that it was a question of tariff reform or of protection.<sup>1</sup> His purpose, which so frequently has been misinterpreted, is best set forth in his own words:<sup>2</sup>

We have to tax now with objects beyond revenue, with objects which are purely temporary, and without regard to the permanent effect upon trade. We must look at the state of our foreign exchange. We must discourage imports. Some of us think that, in ordinary circumstances, imports if excessive will necessarily be discouraged and exports will necessarily increase. But this is not true today. We cannot increase our exports because our capital and labor are otherwise engaged. We have then to look upon the reduction of imports as an object in itself. Then we also have to have strict regard to the necessity of reducing consumption. If, thus, we can by any means of taxation, at one and the same time, reduce imports, and reduce consumption, and bring in revenue, then I think, for the moment at any rate, we may consider to have found an ideal system.

It was also contended in defense of these duties that shipping space would be saved, although this argument could not be advanced for all articles.<sup>3</sup> Of course, the preference proponents were not missing, but such proposals as they made were rejected.<sup>4</sup> As for the length of time that the duties would remain a part of the fiscal system, it was practically promised by Mr. McKenna that they were strictly a war measure and would be discontinued with the passing of the emergency.<sup>5</sup>

<sup>1</sup> *Parliamentary Debates*, Commons, Vol. LXXIV, 1915, Col. 1724-5.

<sup>2</sup> *Ibid.*, Col. 351-2.

<sup>3</sup> Hirst, *op. cit.*, p. 63. Mr. Hirst emphasizes this idea of shipping space economy as an argument for the McKenna duties, though the writer was unable to find any emphasis upon it in the House Debates.

<sup>4</sup> *Parliamentary Debates*, *op. cit.*, Col. 1749-62.

<sup>5</sup> *Ibid.*, Col. 1724-5.

### THE PARIS RESOLUTIONS OF 1916

Concurrently with the adoption of the McKenna duties, in fact since the outbreak of the War, certain suspicions and fears regarding Germany's economic motives had been growing. Business men in general were filled with grave misgivings, and continually disturbed by dreadful apparitions concerning post-war trade. A Sub-Committee of the Advisory Committee to the Board of Trade, conducting an investigation into the condition of a group of minor industries about this time, came to the conclusion that the question of protection was the most important they had to consider. "Practically all the representative firms and associations consulted by us," stated the Report, "asked for a measure of protection."<sup>6</sup> There was a widespread fear, the Committee further noted, that the country would be flooded with German and Austro-Hungarian goods after the War, "sold at any price they would bring with a view to capturing trade hitherto carried on by enemy countries." Business men testified to the Committee that German industries were producing and accumulating stocks preparatory for this purpose.<sup>7</sup>

The Sub-Committee concerned itself with other phases of protection, and in its report urged several recommendations of a revealing nature. If we may interpret them as a rather substantial representation of British business and industrial opinion at that time, some light is shed upon subsequent developments. A portion of the report is well worth quoting in this connection:<sup>8</sup>

We are of the opinion that, when the national supplies of certain manufactured ar-

<sup>6</sup> *Committee's Report*, 1916 (Cd. 8275), p. 11. Of course, some of these industries are those which suffered most from pre-war competition.

<sup>7</sup> *Ibid.*, p. 11.

<sup>8</sup> *Ibid.*, p. 16.



ticles, which are of vital importance to the national safety or are essential to other industries, have fallen into the hands of manufacturers and traders outside this country, British manufacturers ready to undertake the manufacture of such articles in this country should be afforded sufficient tariff protection to enable them to maintain such production after the War.

With reference to the strongly expressed opinion of many of the witnesses that the enactment of protective duties on the industries other than those referred to in the preceding paragraph, which have formed the subject of our inquiry, is essential to their maintenance, we wish to report that in view of the following considerations:

(a) That there exists a strong desire to respond to the feelings of our Dominions in favor of an Imperial Preference in trade, and that there is also a strong desire to arrange preferential trading with those who are our Allies in the present War, and

(b) That the present high direct taxation tends to raise the rate of interest on money, and cheap abundant capital for the employment of their labor is of the greatest importance to the working classes,

It will be necessary to impose some widely spread import duties, and we are therefore prepared to recommend that a larger proportion of the revenue be raised by import duties.

We are of the opinion that such import duties would go a long way towards satisfying the requests for special protective treatment for the industries which we have under consideration.

It was in the sentiment revealed by this Report that the famous Paris Resolutions originated.<sup>9</sup> The same month in which it was published, January, 1916, a motion was made and passed unanimously in the House of Commons, which called upon the Government "to enter into immediate consultation with the Governments of the Dominions, in order, with their aid, to bring the whole economic strength of the Empire into coöperation with our Allies in a policy directed against the

enemy."<sup>10</sup> The Paris Economic Conference followed in June, and passed a series of resolutions, framed in advance by Mr. Walter Runciman, President of the Board of Trade, with the approval of Mr. Herbert Asquith, the Prime Minister; Mr. Walter Long, the Colonial Secretary; and two representatives of the Dominions, Mr. W. M. Hughes, and Sir George Foster. The resolutions included recommendations for Allied economic measures during the period of the War; during the period of reconstruction; and lastly, permanent measures. In them, among other things the Allies agreed to take all necessary steps to make themselves independent of the enemy countries, so far as raw materials and manufactured products, as well as financial, commercial and maritime organization were concerned.<sup>11</sup> Accordingly, almost any methods could be applied in carrying out the agreement, as the subsidizing, direction or control of enterprises by governments; financial assistance for the encouragement of scientific and technical research, and the development of national industries; the application of customs duties or prohibitions of a temporary or permanent character, or a combination of them all. Whatever the method, the object desired was such increased production within Allied territories as to enable them to develop and maintain their economic position independently of enemy countries.

Referring to these resolutions shortly after, Mr. Asquith announced in the House of Commons that they had been adopted as part of the Government's policy, which he hoped met with the approval of Parliament.<sup>12</sup> In defend-

<sup>10</sup> *Ibid.*, p. 38.

<sup>11</sup> Paris Economic Conference, *Resolutions*, 1916 (Cd. 8271).

<sup>12</sup> *Parliamentary Debates*, Commons. Vol. LXXXV, 1916, Col. 340-1.

<sup>9</sup> Hewins, *op. cit.*, pp. 37-40.

ing this action, he gave classic expression to the general trepidation current at the time. He declared:<sup>13</sup>

The War has opened our eyes to the full meaning and manifold implications of the German system of economic penetration, and commercial and financial control of vitally important industries and to the use to which vantage ground gained by this system can be put in war. It is difficult—indeed, I think it is impossible—to believe that Germany would not be animated by the same spirit and policy when the War is over, and that she will start, be it observed, with certain very considerable advantages. They are already organizing their industry—and do not let us be blind to this—for an attack on our Allied markets and for a vigorous and, if possible, victorious competition in neutral markets. It is then in our view—when I say our view I mean the view of the Allied Powers—necessary to make thorough preparations for the coming peace, and the Paris Economic Conference and the Resolutions passed there represent the attempt of the Allies to decide the general lines on which that preparation should proceed.

Adoption of the resolutions as part of the Government's policy was not without opposition, because Mr. Asquith had pledged that the British delegates would return from the Paris Conference uncommitted.<sup>14</sup> The Government announced, however, that no action would be taken immediately, but that a Committee had been appointed under the Chairmanship of the late Lord Balfour of Burleigh, to investigate and present definite means of carrying out the suggestions of the resolutions.<sup>15</sup> Thus, the question of Parliamentary approval was postponed until the report from this Committee was received, and definite proposals were ready to be made.

<sup>13</sup> *Parliamentary Debates, Commons.* Vol. LXXXV, 1916 Col. 333.

<sup>14</sup> *Ibid.*, Col. 380-2.

<sup>15</sup> *Ibid.*, Col. 339.

#### THE LORD BALFOUR OF BURLEIGH COMMITTEE

The Committee, known as the Committee on Industrial and Commercial Policy after the War, was composed of both Conservative and Liberal members. It began its work at once and shortly issued an interim report, which appeared just before the meeting of the Imperial War Conference, a Conference consisting of all the Colonial Premiers. The Committee felt, as they stated in an accompanying letter to the Prime Minister, that, though acts in restraint of trade are distasteful in the abstract, Imperial interests made a serious attempt to meet the declared wishes of the dominions and the colonies very desirable.<sup>16</sup> The sacrifices made and the services rendered, it was further stated, made the time particularly appropriate for the declaration of such a policy. Then, too, the Committee felt that the recovery of trade lost during the War, the securing of new markets, and the consolidation of Empire resources could best be facilitated throughout the Empire, by a system of mutual protection. Consequently, the Committee presented the following resolutions:<sup>17</sup>

1. In the light of the experience gained during the War, we consider that special steps must be taken to stimulate the production of food-stuffs, raw materials and manufactured articles within the Empire wherever the expansion of production is possible and economically desirable for the safety and welfare of the Empire as a whole.

2. We therefore recommend that His Majesty's Government *should now declare their adherence to the principle that preference should be accorded to the products and manufactures of the British overseas Dominions, in respect of any Customs Duties now or hereafter to be imposed on imports into the United Kingdom.*

<sup>16</sup> *Interim Report*, 1917. (Cd. 8482), p. 1.

<sup>17</sup> *Ibid.*, p. 3. (Italics are the writer's).

3. Further, it will, in our opinion, be necessary to take into consideration, as one of the methods of achieving the above objects, the desirability of establishing a wider range of Customs Duties which would be remitted or reduced on the products and manufactures of the Empire and which would form the basis of commercial treaties with Allied and Neutral Countries.

#### THE RESOLUTIONS OF THE IMPERIAL WAR CONFERENCE, 1917

The Imperial War Conference, which had been called for the purpose of securing closer co-operation within the Empire in pushing the War, met early in the spring of 1917. After due deliberations, of which but smatterings are published, a resolution was passed by the Conference favoring the establishment of an Imperial preference system. Since the resolution had previously met with the unanimous approval of the Imperial War Cabinet, consisting only of Imperial Prime Ministers, its adoption in reality was mere reaffirmation.<sup>18</sup> It represented, as passed, not only an expression of opinion by the Colonial representatives, as had former resolutions of Imperial Conferences, but also the expression of an opinion by the British Government. Thus, Great Britain tied herself definitely to a policy of Imperial preference.

This resolution which Mr. Hewins describes as the "key" resolution to future developments of policy, declared in definite terms that "the time has arrived when all possible encouragement should be given to the development of Imperial resources, and especially to making the Empire independent in respect to food supplies, raw materials, and essential industries."<sup>19</sup> The resolution contained a clause, moreover, which expressed unequivocal approval of the principle that

each part of the Empire should give especially favorable treatment and facilities to the produce and manufactures of other parts of the Empire, with due regard, of course, for the interests of the Allies. In addition, arrangements should be made to induce British emigrants to settle within the Empire. Concerted Imperial action, finally, was deemed necessary to arrange in the future for an adequate food supply and its transportation, and also for the control and economical utilization of resources essential for national purposes.

Since this action was concurred in by the British Government, the next step was the working out of a practical preference plan. Mr. Long, the Colonial Secretary, announced in the House of Commons, a Cabinet Committee to inquire and report on the methods required to render the resolution effective.<sup>20</sup> This Committee, called the Committee on the Trade Relations of the United Kingdom within the Empire, considered a group of subjects such as: (1) preference both by means of tariff and administrative measures, (2) the position of commercial treaties in view of conditions arising out of the War; (3) the resources of the British Empire.<sup>21</sup>

#### THE LORD BALFOUR OF BURLEIGH COMMITTEE, FINAL REPORT

In the meantime, the final report of the Balfour of Burleigh Committee was received, recommending a comprehensive change in the fiscal policy. These recommendations are the culmination of the war movement toward tariff protection. Their inclusion here is, therefore, pertinent:<sup>22</sup>

(1) The producers of this country are

<sup>18</sup> *Parliamentary Debates*, Commons, Vol. XCVII, 1917, Col. 1003.

<sup>19</sup> Hewins, *op. cit.*, pp. 43-4.

<sup>20</sup> Committee on Commercial and Industrial Policy after the War, *Final Report*, 1918 (Cd. 9035), p. 52.

<sup>18</sup> Hewins, *op. cit.*, pp. 41-2.

<sup>19</sup> *Proceedings of the Imperial War Conference*, 1917 (Cd. 8566), pp. 114-5.

entitled to require from the Government that they should be protected in their home market against "dumping" . . . , and against the introduction of "sweated goods." . . . We agree that it will often be difficult to distinguish between "dumping" and between cheap production and "sweating," but it will be the duty of our trade representatives in foreign countries to investigate and report on these matters, and reliance must be placed upon the manufacturers in this country, so that the operations of the customs officials may be intelligently directed to stop these unfair forms of trade.

(2) Those industries which we have described as "key" or "pivotal" should be maintained in the country at all hazards, and at any expense. No ordinary economic rules apply to the situation of these minor but important industries. They must be kept alive, either by loans, by subsidies, by tariffs, or Government contracts, or in the last event, by Government manufacture. They will necessarily be subject to Government supervision.

(3) As regards other industries, protection by means of customs duties or Government assistance in other forms should be afforded only to carefully selected branches of production which must be maintained either for reason of national safety, or on the general ground that it is undesirable that any industry of any importance to our economic strength and well-being, should be allowed to be weakened by foreign competition, or brought to any serious extent, in this or other ways, under alien domination or control.

(4) Preferential treatment should be accorded to the British Overseas Dominions and Possessions, in respect of any Customs Duties now, or hereafter, to be imposed in the United Kingdom, and consideration should be given to the expediency of other forms of Imperial Preference.

(5) As regards our commercial relations with our present Allies and with Neutrals, the denunciation of existing commercial treaties for the purpose of affording special treatment to such of our Allies or of the Neutrals as might be disposed to make reciprocal concessions, is unnecessary and unexpedient. But the present opportunity should be taken to endeavor to promote our trade with the Allies, and consideration

should be given to the possibility of utilizing for purposes of negotiation with them and present Neutrals, any duties which may be imposed in accordance with the principles which we have laid down before.

In addition to these recommendations, a Special Industries Board was proposed, to work with the Board of Trade, in determining essential industries which should otherwise be maintained on general grounds of safety or economic desirability.<sup>23</sup> Some assistance to such industries ought to be extended, it was felt, but it was admittedly difficult to determine just what industries should be included. The Committee suggested that the list might possibly include, indeed, appeared to them to include, the heavy iron and steel industries, the numerous branches of manufactured iron and steel goods; the engineering trades, including electrical and motor engineering; the production of a considerable number of non-ferrous and ferro-alloys; ship-building; many branches of the chemical trades; the textile trades, almost as a whole; the manufacture of various classes of rubber goods, especially tires; and the leather industries.<sup>24</sup> Nearly every important British industry is included in one of these categories; and hence, falls within the scope of this recommendation, according to the Committee itself.

As a matter of fact, most of the industries in question did feel that they should be the recipients of protection under this head. The accompanying table, Table I, which will merit the reader's careful attention, summarizing the recommendations of various Departmental Committees appointed by the Board of Trade to consider the position of some of these industries fol-

<sup>23</sup> Committee on Commercial and Industrial Policy after the War, *Final Report*, 1918 (Cd. 9035), p. 52.

<sup>24</sup> *Ibid.*, p. 44.



TABLE I—GIVING SUMMARIES OF THE STATEMENTS AND RECOMMENDATIONS WITH REGARD TO PROTECTIVE TARIFFS FOUND IN THE REPORTS OF THE VARIOUS DEPARTMENTAL COMMITTEES APPOINTED BY THE BOARD OF TRADE TO CONSIDER THE POSITION OF CERTAIN INDUSTRIES AFTER THE WAR

Industry	The Position of the Industry on Protective Tariffs as Evidenced by the Reports	Amount and Type of Tariff Suggested
Electrical Trades <sup>1</sup>	Many witnesses expressed the view that protection would be necessary after the War	Duties should be sufficiently high to afford ample protection. Measures should be enacted against dumping
Engineering Trades <sup>2</sup>	Majority of Committee believed tariff would be necessary	No definite suggestions, save with regard to preference which ought to be large enough to induce reciprocal treatment
Iron and Steel Industries <sup>3</sup>	Committee believed that safeguarding would be necessary. Feeling unanimous in industry for this sort of protection. Also a general protest against dumping	Amount should be large enough to safeguard and protect industry. Preferences large enough to induce reciprocity should be given. Dumping should be prevented
Shipping and Ship-building Trades <sup>4</sup>	Committee reported industry as opposing duties on any article used by them, urging need of freedom in making purchases. Sentiment in favor of anti-dumping legislation <sup>4a</sup>	
The Textile Trades: (a) The Cotton Industry <sup>5</sup>	Little demand in this industry for any change in the present policy. Fear increase of production costs if duties imposed	
(b) The Woolen Industry <sup>6</sup>	Differences of opinion among producers of woolen and worsted goods for men. Dress goods producers favor protection	Dress goods producers desire a small tariff on yarns and a higher one on dress goods
(c) The Carpet Industry <sup>7</sup>	Large majority of producers in this industry seem to favor protection	A tariff as high as 20 per cent suggested, with preference for the Dominions and Allies
(d) The Silk Industry <sup>8</sup>	Practically a unanimous request for a tariff. Said to be an "infant" industry	Varying duties suggested from 12 per cent to 40 per cent with Empire goods free
(e) The Jute Industry <sup>9</sup>	In favor of protection, especially a type of export duties profitable to itself	An export duty on jute leaving India with a refund in favor of Empire destinations



TABLE I—Continued

Industry	The Position of the Industry on Protective Tariffs as Evidenced by the Reports	Amount and Type of Tariff Suggested
(f) The Linen Industry <sup>1</sup>	A general feeling in favor of protective duties	No suggestion save that distinction be made between Allied and enemy countries
(g) The Hosiery and Fabric Glove Industry <sup>2</sup>	A practically unanimous demand for tariff protection in the hosiery industry. Cotton hosiery and gloves ask for protection to establish large scale production (infant industry)	No particular amount of tariff duties suggested
(h) The Lace Industry <sup>3</sup>	Same situation as above. Machine lace industry in need of protection to establish large scale production	No particular amount of tariff duties suggested

<sup>1</sup> Departmental Committee Appointed by the Board of Trade to Consider the Position of the Electrical Trades After the War, *Report*, 1918 (Cd. 9072), pp. 8, 9 and 12.

<sup>2</sup> Same, *Engineering Trades, Report*, 1918 (Cd. 9073), p. 37.

<sup>3</sup> Same, *Iron and Steel Industries, Report*, 1918 (Cd. 9071) pp. 28-32. Two members of the Committee dissented from the majority opinion that protection would be necessary after the War.

<sup>4</sup> Same, *Shipping and Ship-building Trades, Report*, 1918 (Cd. 9092) pp. 28-9.

<sup>5</sup> Same, *Textile Trades, Report*, 1918 (Cd. 9070), pp. 122-4.

lowing the War, shows us the extent to which this was true.<sup>25</sup> Only one, ship-building, was opposed in any strenuous way to the proposal of tariff protection; most of the others, save cotton, were apparently strongly in favor.<sup>26</sup> The same conviction among business men, that protection following the War would be highly beneficial, had been expressed earlier for certain of the minor industries.<sup>27</sup> Beyond a doubt, a general sentiment was being crystallized among industrialists in favor of

fiscal revision, if not in favor of adopting a comprehensive tariff system.

#### THE IMPERIAL CONFERENCE OF 1918 AND THE CLOSE OF THE WAR

These recommendations of the Balfour of Burleigh Committee did not lead to immediate action on the part of the Government, for it was commonly understood that no action was to be taken until after the close of the War. They were, however, considered by the Imperial War Conference of 1918, and were made the basis of a number of "practical resolutions," in the form of recommendations for consideration by the respective Governments of the Empire.<sup>28</sup> The recommendations constituted a large scheme for the economic

<sup>28</sup> Mr. Hewins was Chairman of an Economic Committee of the Imperial War Conference which drafted the recommendations. See his book, *op. cit.*, pp. 44-5.

<sup>25</sup> See citations at foot of Table I.

<sup>26</sup> It is significant, perhaps, to point out here that the number of persons employed in the industries favorable to protection was roughly 14 per cent of the total number of persons gainfully employed, in June, 1921. This figure has been obtained from a study of population statistics contained in the Committee on Industry and Trade, *Survey of Industrial Relations*, pp. 403-15.

<sup>27</sup> Sub-Committee to Advisory Committee of Board of Trade, *Report*, *op. cit.*

development of the Empire, and were approved unanimously.<sup>29</sup> The chief concern behind them, according to Mr. Hewins, was Imperial development during the period of reconstruction, the duty of the British being first to set their own house in order. Representatives of the Empire at the approaching Peace Conference could be guided thus in defining their position.<sup>30</sup>

Shortly after the War came to a close, there followed the famous election of 1918, by which Mr. Lloyd George was returned to power at the head of a new Coalition Government. Like its predecessor, it was a compromise, and because of this, did not submit the resolution of the 1917 Imperial War Conference to the House of Commons, as would have been the constitutional procedure.<sup>31</sup> It was clear, however, what position the new Government would take on this question. Mr. Lloyd George had addressed the Lord Privy Seal prior to the formation of his election manifesto.<sup>32</sup>

I have already accepted the policy of Imperial Preference as defined in the resolution of the Imperial Conference to the effect that a preference will be given on existing duties which may subsequently be imposed. As regards other aspects of this problem, I am prepared to say that the "key" industries on which the life of the nation depends must be preserved. I am prepared to say also that in order to keep up the present standards of production and develop them to the utmost extent possible, it is necessary that security should be given against the unfair competition to which our industries have been in the past subjected by the dumping of goods below the cost of production. Beyond this I should say we must face all of these questions with new eyes, without regard to pre-war views or pre-

war speeches. The object which we have in view is to increase to the greatest possible extent production in this country. . . .

#### THE INTRODUCTION OF PREFERENCE INTO BRITISH TARIFF LEGISLATION

When Parliament met again, it was announced that a bill would be introduced shortly for the prevention of dumping.<sup>33</sup> None appeared and the proposal was forgotten temporarily upon the presentation of the Budget, introduced by Mr. Austen Chamberlain, then Chancellor of the Exchequer. Here it was proposed to allow preferences upon a number of existing duties.<sup>34</sup> The range of duties upon which preference was to be granted was not large, and no proposal was made to increase their number, a procedure which is said to have side-tracked free trade opposition. But Mr. Chamberlain observed with some significance in his Budget speech that: "Though the beginnings be small, there are vast opportunities for the development of British Imperial trade to be secured by promoting that trade along the line of preference."<sup>35</sup> In other words, this was merely, in his conception, a first step. Included in the plan was a preference grant of one-third on the McKenna duties, which were to be continued; a preference grant of one-sixth on tea, coffee, sugar, and motor spirits; and a preference of varying rates upon wines and spirits. The approval of Parliament being gained subsequently, the British Government had given concrete expression, finally, to its war-time admission of the principle of Imperial preference.

#### THE APPEARANCE OF SAFEGUARDING

Following suggestions which had been made consistently during the War period, for the exclusion of cer-

<sup>29</sup> *Proceedings of the Imperial War Conference, 1918, (Cd. 9177), pp. 4-9.*

<sup>30</sup> Hewins, *op. cit.*, p. 45.

<sup>31</sup> *Ibid.*, p. 46.

<sup>32</sup> Quoted in *Parliamentary Debates, Commons, Vol. 114, 1919, Col. 323-4.*

<sup>33</sup> King's Speech quoted, *Ibid.*, Col. 326.

<sup>34</sup> Budget Speech, *Ibid.*, Vol. 115, Col. 198-9.

<sup>35</sup> Budget Address, *Ibid.*, Col. 195.

tain imports during the years immediately following the cessation of hostilities, in order to afford British industry an opportunity to recover, effort was made by the Coalition Government to continue the controls and embargoes established for emergency purposes. No less than two hundred and sixty classes of goods, writes Mr. Hirst, were either prohibited or were allowed to enter British ports only in restricted quantities under licenses granted by the Board of Trade.<sup>36</sup> This practice was the cause of no little criticism. Lord Parmoor, in the House of Lords, asserted that these embargoes and licenses were illegal. A crisis was reached just before Parliament adjourned, in August, when Sir John Simon announced his intention of importing certain prohibited goods from Spain.<sup>37</sup> A few days later, Mr. Lloyd George told the House of Commons that the policy was to come definitely to an end on September 1, explaining that it had been retained merely to shield industries during the period of demobilization, and that no further justification for it appeared to exist.<sup>38</sup>

When Parliament met again, the Coalition Government introduced an anti-dumping bill. It received little support and consequently, was not pushed. There was arising considerable opposition to the continuance of Government domination in business, which had come to obtain because of the War. This fact was one of the chief subjects of controversy during 1920. A return to free trade sentiment was occurring. It even appeared that the Government proposals for the protection of certain "key" industries would be rejected when introduced.<sup>39</sup>

Such a complete reversal of sentiment, however, did not come about, as was evidenced by the acceptance of the Dye-stuffs Import Regulation Bill which was introduced in December.<sup>40</sup>

The passage of this act prepared the way and assured the introduction of the Safeguarding of Industries Bill. Compelled by the pressure of its Conservative participants, the Lloyd George Coalition finally offered two resolutions in the House of Commons to make good its election promises.<sup>41</sup> The first provided that a customs duty of 33.3 per cent *ad valorem* should be imposed upon nine classes of articles whose manufacture was considered to be essential to success in war. These "key" articles included optical glass, laboratory porcelain, hosiery latch needles, metallic tungsten, and all synthetic organic chemicals. The second resolution provided that a similar duty should be imposed on articles offered for sale in the United Kingdom at prices below their cost of production, or at prices below those at which similar goods could be manufactured in the Empire, owing to a depreciation of currency in the country of origin. Manufacturers desiring protection under the second resolution were to apply to the Board of Trade, who would appoint a committee to survey the facts of their case, and report. The Board of Trade, upon a favorable report, could then issue an order authorizing the application of the duty, allowed under the second resolution, for three years. Such an action by the Board of Trade was subject to confirmation by Parliament. Duties for different reasons could be levied simultaneously, but the total could not exceed 66 per cent.

<sup>36</sup> Hirst, *op. cit.*, pp. 64-5.

<sup>37</sup> *Ibid.*, pp. 65-6.

<sup>38</sup> *Parliamentary Debates*, Commons, Vol. 119, 1919, Col. 2009-10.

<sup>39</sup> Hirst, *op. cit.*, p. 67.

<sup>40</sup> *Public Bills*, Vol. I, 1920, Bill 269. This bill made the importation of dye-stuffs illegal save under license.

<sup>41</sup> *Parliamentary Debates*, Commons, Vol. 142, 1921, Col. 867.

The Bill embodying these resolutions was not finally passed until August, 1921.<sup>42</sup> As Mr. André Siegfried has described it, it was "a regular Protectionist arsenal."<sup>43</sup> Its passage is extremely important, because it represents the climax reached by the protectionist movement arising directly out of the War. Furthermore, it was the last act to be justified by the Paris Resolutions.<sup>44</sup> To be sure, under Part I of the Bill, which went into force, October, 1921, duties were imposed for only five years; and under Part II, they could be levied for only three years.

<sup>42</sup> *Public Bills*, Vol. I, 1921, Bill 183.

<sup>43</sup> Siegfried, A., *Post-War Britain*, (N. Y., Dutton, 1924), p. 25.

<sup>44</sup> *Parliamentary Debates*, Commons, 1921, Vol. 146, Col. 843-922.

In addition, the minute precautions of the second half, made its application most difficult. A large number of articles were added, nevertheless, to the British tariff list by Part I. So many, in fact, that Mr. Hewins was led to assert: "After the passage of this Act, it was, of course, absurd to suggest that this country any longer retained the Free Trade system."<sup>45</sup>

The War left many marks upon British institutions; and not the least important of these was the change affected in the fiscal system. This change might have proved to be a temporary one, which would be eradicated in the course of time. Our next chapter, therefore, will treat of the movement up to the present time.

<sup>45</sup> Hewins, *op. cit.*, p. 50.

### CHAPTER III

#### RECENT MANIFESTATIONS OF PROTECTION, 1921 TO 1927

**F**OLLOWING the passage of the Safeguarding of Industries Act, the tariff schedule of Great Britain included, first, the old revenue duties which had long existed as part of the British fiscal system; second, the McKenna duties which had been applied continuously since their introduction in 1915; third, duties upon numerous articles which came under Schedule I of the new Safeguarding of Industries Act. Preferences of varying amounts were allowed upon these three groups of duties. Finally, there existed Schedule II of the new Act, the application of which we have not considered as yet. Admittedly, such a tariff schedule contained a more extensive commodity protection than a staunch Liberal free trader would have liked. Much of it represented a compromise between the two principal parties during the years of critical

emergency; it was not the result of a deliberate program of the Conservative Party. Therefore, the years following the War might well have witnessed its obliteration. No such thing occurred, as we shall see in this chapter.

#### THE APPLICATION OF THE SAFEGUARDING OF INDUSTRIES ACT, SCHEDULE II

Shortly after the passage of this Act, several industries made application for inclusion under Schedule II which embodied the second resolution on safeguarding introduced by the Lloyd George Coalition Government. They alleged that German competition was made possible by that country's depreciated currency. The Board of Trade appointed committees to investigate, and their findings being in the affirmative an Order was issued subsequently by the Board granting



the industries protection. Among those allowed relief by this means were the manufacturers of fabric gloves, glove fabrics, domestic glassware, and domestic hollow-ware of aluminum or enameled iron or steel.<sup>1</sup> Another Order was issued shortly including gas mantles for the same reason.<sup>2</sup> No other inclusions were allowed, although a number of applications were received. This was due in part to the difficulties encountered by investigating committees in their efforts to determine whether goods were being sold below their cost of production in countries of origin, owing to the depreciation of their currencies.<sup>3</sup> It was also due to the official British interpretation of commercial treaties. Duties under this section of the Act could be allowed only against goods imported from Germany, because no commercial treaty was in existence with that country.<sup>4</sup> Again, because of these treaty complications preferences could not be granted under Schedule II.<sup>5</sup>

After a year's existence, the Safeguarding of Industries Act had fallen into serious disfavor. It did not seem to be accomplishing those things which had been promised for it. British trade and commerce, had sunk into severest depression. Apparently, the sentiment against protectionism had grown quite intense, for when Mr. Lloyd George's Government fell, Mr. Bonar Law pledged that, if he were returned to power, there would be no further change in the fiscal system of the country.<sup>6</sup> Security and confidence, which were so essential to Britain's recovery, he asserted, could be ob-

tained best by refraining from any experiment; but he, of course, believed that she would profit by a change in the long run. He also pledged that fiscal policy was not an issue of the election, and that his party would take no steps in that direction without a mandate from the electorate. Such a pledge from a leading protectionist politician may be reasonably interpreted as reflecting a popular reaction against additional tariff reform.

#### THE IMPERIAL ECONOMIC CONFERENCE OF 1923

Mr. Bonar Law had also announced his adherence to the policy of Imperial Conferences, during the campaign preceding his election. The last Conference had been held in 1921, but had not considered the usually commanding problem of protection and Imperial preference.<sup>7</sup> An Imperial Customs Conference had met at the same time but had dealt with only minor problems of technical uniformities.<sup>8</sup>

Upon his return to office, Mr. Law announced the meeting of another Conference to consider political problems of the Empire, and at the same time, an Imperial Economic Conference to treat economic problems. Because of his pledge upon protection, however, the probable success of any consideration of the preference question by the Conference was greatly jeopardized. As the situation stood, a Conservative Government, which had been tied to an Imperial policy since 1907, apparently did not intend to propose any measures of a fiscal nature to render that policy effective.<sup>9</sup>

Preparations for the two Conferences progressed, and a date was set for

<sup>1</sup> Order No. 1, *Board of Trade Journal*, Vol. 109, pp. 141-2.

<sup>2</sup> Order No. 2, *ibid.*, p. 418.

<sup>3</sup> Hewins, *op. cit.*, p. 49.

<sup>4</sup> *Ibid.*, p. 177.

<sup>5</sup> *Ibid.*, p. 50.

<sup>6</sup> Speech in South London, Nov. 7, 1922. See *The Times* (London), Nov. 8, 1922.

<sup>7</sup> *Proceedings of the Imperial Conference*, 1921 (Cmd. 1474).

<sup>8</sup> *Proceedings of the Imperial Customs Conference*, 1921 (Cmd. 1231).

<sup>9</sup> Hewins, *op. cit.*, p. 57.



their meeting in October, 1923. The Empire Development Union, an official organization which had been formed to develop an Imperial economic policy, cabled the circumstances to the Governments of the various Dominions, and requested that they come to the Conferences prepared to consider and evolve only concrete schemes for Imperial expansion.<sup>10</sup> Preference proposals, among other topics which might be considered, were suggested by this communication.

Several months before the Conference was scheduled to meet, ill health forced Mr. Bonar Law to resign the premiership, and he was succeeded in office by Mr. Stanley Baldwin, who set out to follow his predecessor's policies. For a while, he appeared to be successful in his purpose, and no fiscal changes with regard to duties were suggested in the Finance Bill of 1923.<sup>11</sup> Even the McKenna duties were renewed again, so rigidly did the Conservatives follow Mr. Law's pledge, though Mr. McKenna in a letter to a musical instrument importer complained that the Government had betrayed his purpose in not removing them after the War.<sup>12</sup>

The Imperial Economic Conference met, as scheduled, on October 1st. In one of the opening addresses, Sir Philip Lloyd-Greame, President of the Board of Trade, urged the need of accelerating the development of Imperial resources.<sup>13</sup> He asserted that, since Great Britain had definitely established the principle of Imperial Preference in her fiscal system, she now wished to apply the principle further within such limits as practicable to

achieve the end desired. In the responding addresses of the Colonial Prime Ministers, many favorable comments were made on the efficacy of British preferences. For example, Mr. Mackenzie King stated that Canada had been influenced to offer additional preferences by Britain's new attitude.<sup>14</sup> South Africa, according to General Smuts, was prepared to reshape her fiscal policy for greater common advantage.<sup>15</sup> The same sentiment was expressed by the representatives for both New Zealand and Australia.<sup>16</sup>

The British Government was prepared to meet this display of preference approval by some new proposals. Several days later, when the subject was set for discussion, Sir Lloyd-Greame asserted that, since the facts revealed the value of preference so clearly, his Government was now ready to make several offers of further grants.<sup>17</sup> He then proceeded to outline the additional reduction which the Government thought worth while on a group of articles imported from colonial sources; *i.e.*, certain dried fruits, currants, sugar, and tobacco, upon which duties were already in existence, other dried fruits and preserved fruits upon which duties would have to be imposed. The amount of preference on all the above articles save sugar and tobacco was named to be 100 per cent, while on these latter the offer was made of a ten-year guarantee for the maintenance of existing preference rates, with the possible alternative, in the case of tobacco, of an increase in the rate of preference.

The reaction of the colonial representatives is a story in itself. One by one, they arose and expressed their appreciation, and each in turn enumerated a list of additional products

<sup>10</sup> Quoted in full, *ibid.*, pp. 57-63. See especially pp. 62-3.

<sup>11</sup> See Mr. Baldwin's Budget Speech, *Parliamentary Debates*, Commons, Vol. 162, 1923, Col. 1737-40.

<sup>12</sup> Quoted by Mr. Hirst, *op. cit.*, p. 79.

<sup>13</sup> *Proceedings of the Imperial Economic Conference*, 1923 (Cmd. 2009), p. 31.

<sup>14</sup> *Ibid.*, pp. 36-7.

<sup>15</sup> *Ibid.*, pp. 47-8.

<sup>16</sup> *Ibid.*, p. 40 and pp. 57-83.

<sup>17</sup> *Ibid.*, pp. 175-8.

which his respective Government would be gratified to have granted preferential entrance into the markets of the United Kingdom.<sup>18</sup> Only the Indian delegate refused to commit his Government to preference, although he saw no reason for actively opposing it. It was a strange occasion, but the representatives of the Crown were equal to it. Their motives are not difficult to divine. For the moment, free trade traditions were discarded or forgotten; the ideals of an economically unified empire took their place. The Conservative Ministers, imbued with a ripe Imperial enthusiasm and stimulated by the all-pervasive nature of British trade depression, rose again boldly and raised their bid for Empire markets. Trade had been suffering the deadliest of ills. Pressure on business and commercial interests had never been so intense. Rumors full of the direst pessimism were current. In short, the time was propitious, the stage was set. There was every reason to believe that the electorate would approve this step in the hope of trade revival.

The Crown extended its offer by including an additional preference on tobacco; preferences upon raw apples, canned salmon, fruit juices; honey to the extent of 100 per cent; then an increase in the preference on wines and sparkling wines; and finally, a duty to be imposed upon barley and hops with a preference of one-third.<sup>19</sup> Even this Imperial gesture did not entirely satisfy the varied interests represented in the Conference, and each, amid profuse thanks, enumerated still other things upon which a preference would be desirable.<sup>20</sup> It appeared from this proceeding, that, now the British Government had crossed the Rubicon, there

would be no end to the demands made upon it. In final approbation of the British preference proposals, the Conference unanimously reaffirmed the Preference Resolution of 1917.<sup>21</sup>

The above recital is not, however, the entire story of protection as dealt with by the Imperial Economic Conference of 1923. Many other proposals were made, including several untimely ones by Mr. S. M. Bruce, of Australia, for placing duties on, or granting other protection to principal food stuffs and raw materials with preferential arrangements for Empire products.<sup>22</sup> These proposals were, of course, rejected in toto by referring them to a committee which reported unfavorably. The remaining discussion given to protection was devoted to a consideration of confining government contracts to Empire products, with resolutions covering this point presented and passed.<sup>23</sup>

#### THE FALL OF THE CONSERVATIVES ON THE ISSUE OF PROTECTION

We have already suggested motives for the preference proposals of the Conservative leaders, and subsequent developments tend to verify them. Notwithstanding this, at the time, their proposals were the cause of much conjecture and criticism. Mr. Bruce added to the tenseness already existing in many quarters by publicly insisting that the United Kingdom would reap a profit from duties on foods and materials with preference grants on the same to the Empire.<sup>24</sup> Strong resolutions were passed by the protagonists of free trade in various organizations protesting against the Government's breach of faith.<sup>25</sup>

The Government was not slow in making clear its intentions; and on

<sup>18</sup> *Proceedings of the Imperial Economic Conference, 1923* (Cmd. 2000), pp. 183-88.

<sup>19</sup> *Ibid.*, pp. 203-6.

<sup>20</sup> *Ibid.*, pp. 206-34.

<sup>21</sup> *Ibid.*, p. 238.

<sup>22</sup> *Ibid.*, pp. 57-83.

<sup>23</sup> *Ibid.*, pp. 253-4.

<sup>24</sup> See the *Nation* (London), Vol. 34, pp. 110-1.

<sup>25</sup> Hirst, *op. cit.*, p. 81.

October 25th, Mr. Baldwin, in an address to the annual Conservative caucus at Plymouth, announced that, while he regarded the unemployment problem as the most critical one facing the country, he could do nothing about it without a weapon of some sort.<sup>26</sup> After considering all the factors in the situation, he had concluded that "the only way of fighting this subject is by protecting the home market." The Government's position was made still more comprehensible by the following statement in the House of Commons during the debate on the Labor censure resolution. Mr. Baldwin said:<sup>27</sup>

"What the Government desires is release from the pledge given a year ago, to enable them to impose duties on manufactures generally for purposes of revenue and tariff negotiations, together with the full power to impose larger duties when the circumstances of particular industries require it. The Safeguarding of Industries Act is far too limited in its application to deal with goods from Germany which are today threatening our industry. . . . The Government has come to the conclusion that they cannot deal with this measure sporadically by an act of the nature of the Safeguarding of Industries Act, and that, if you want either to negotiate effectively, or if you want to give dominion preference, or if you want to raise revenue, you must make your duties general, even if they be but duties for revenue purposes."

The election which resulted from this issue was a bitter contest. No complete scheme for a general tariff was advanced in the campaign. A committee sat in secret, however, preparing a specific tariff plan, but no details were published.<sup>28</sup> The issue was the

broad one of protection. Food duties, promised Mr. Baldwin, would never be imposed upon essential items. To tempt the farmers, he offered a subsidy paid out of the import duties on manufactures.<sup>29</sup> Whatever the leaders of tariff reform may have anticipated, the campaign, based upon the issues cited fell short in its appeal to the people. When the results were in, the Conservatives found themselves with a minority, and upon the refusal of the Liberals to support them, gave way to the formation of the Labor Government.

#### THE LABOR GOVERNMENT AND FREE TRADE

Mr. Phillip Snowden, who became Chancellor of the Exchequer under Mr. Ramsay MacDonald, proceeded to interpret the defeat of the Conservatives as a clear mandate for the resumption of free import practices.<sup>30</sup> Accordingly, in his Budget, he eliminated the McKenna duties, and cut the existing tariff on sugar, tea, coffee and dried fruits. He made no effort to change prevailing preferences, but he denied the right of the former Government to pledge the maintenance of any preferences for specified periods, as had been done at the recent Imperial Economic Conference. As for the resolutions passed by that Conference, he would submit them to the House of Commons and abide by their decision. Finally, with regard to present Safeguarding of Industries duties, under Part II of that Act, he proposed to allow them to run their natural course, since they would terminate shortly.

The Budget was readily accepted by the House of Commons; but some difficulty was encountered in defeating the resolutions of the Imperial Eco-

<sup>26</sup> See speech quoted in *The Times* (London), Oct. 26, 1923.

<sup>27</sup> *Parliamentary Debates*, Commons, Vol. 168, 1923, Col. 485-6.

<sup>28</sup> The committee consisted of Viscount Milner, Professor Sir William Ashley, Professor Hewins and one or two business men. See Hirst, *op. cit.*, p. 84.

<sup>29</sup> *Ibid.*, p. 83.

<sup>30</sup> *Parliamentary Debates*, Commons, Vol. 172, 1924, Col. 1598-1604.

conomic Conference. After extended debate, however, the Government succeeded in getting them all rejected, even if by extremely close margins.<sup>31</sup> The ideal of a closely unified Empire was capable, apparently, of arousing strong sympathy and support, even in a situation hostile to a more inclusive protectionism.

#### THE RETURN OF THE CONSERVATIVES AND NEW PROPOSALS FOR SAFEGUARDING

The Labor Government was not destined to remain long in power, and in November of that year, a defeat at the polls forced its retirement from office. During the election, no issue was raised regarding fiscal policy, but when Parliament reconvened in December, the King announced in His address that: "A bill is under consideration and will be submitted . . . at an early date for safeguarding employment in efficient industries, where the need for exceptional action is established."<sup>32</sup> In defending this course, Premier Baldwin set forth a series of principles which were going to be fundamental in the Government's new safeguarding act.<sup>33</sup> First, any industry, to be safeguarded, must be one of substantial importance, and it must be efficient. Second, an industry to be safeguarded, must be subject to exceptional competition arising from such things as depreciated exchanges, bounties or subsidies, lower wages or longer hours in foreign countries and differences in tax burdens. Third, any duty must be a general and not a particular one, to avoid treaty complications. Fourth, a preference should be granted to the dominions.

No bill was forthcoming, however; the Government evidently had changed its tactics. Early in February, the

Board of Trade issued in a "White Paper," the Government's new plan of safeguarding.<sup>34</sup> Under this arrangement, no bill was to be introduced. Instead, the Board of Trade would appoint investigating committees, and upon favorable report by them with the concurrence of the Board and the Treasury, the Government would include their recommendations in the Finance Bill. Duties would be imposed only for a limited period, the plan provided, but this period would vary with each case and would be prescribed by the Government in its finance proposals. The rules to be applied by the Board of Trade when applications are received, were modelled upon the principles set forth by Mr. Baldwin in the House of Commons:<sup>35</sup>

(1) The Board must be of the opinion that the industry applying for an inquiry in respect of the whole or any part of its production, can reasonably be regarded as of substantial importance on account either of the volume of employment engaged in such production, or of the nature of the goods produced.

(2) The Board must be of the opinion that there is *prima facie* evidence that the competition of foreign imports in the industry is exceptional, and that by reason of such competition, employment in the production of goods in question in the United Kingdom is being, or is likely to be, seriously affected.

(3) The applicant industry must show that in countries from which competition comes, the conditions in one or more respects set out in paragraph (5) of the Rules hereunder, for the guidance of committees, are so different from those in this country as to render the competition unfair.

(4) The Board of Trade will in their discretion, reserve the right to refuse an inquiry, irrespective of other conditions ob-

<sup>31</sup> The substance of this "White Paper" is available in the *Board of Trade Journal*, Vol. CXIV, pp. 170-1, or see Board of Trade, *Safeguarding of Industry, Procedure and Enquiries*, 1924-5 (Cmd. 2327).

<sup>32</sup> *Ibid.*, p. 170.

<sup>31</sup> *Parliamentary Debates, Commons*, Vol. 174, 1924, Col. 1863-2286.

<sup>32</sup> *Ibid.*, 1925, Vol. 179, Col. 49-50.

<sup>33</sup> *Ibid.*, Col. 1064.



taining in the industry, if they are of the opinion that the industry is not carried on in this country with reasonable efficiency and economy, or that the imposition of a duty on goods of this class or description in question would have a seriously adverse effect upon employment in any other industry, being an industry using goods of that class or description in production.

When the approval of the Board of Trade had been gained, the committee appointed to pursue further inquiry was instructed to report on the following questions:

(1) Whether the applicant industry is, by reason of the volume of employment, engaged in the production of the goods to which the application relates, or by reason of the nature of the goods produced, an industry of substantial importance.

(2) Whether foreign goods of the class or description to which the application relates, are being imported into and retained for consumption in the United Kingdom in abnormal quantities.

(3) Whether the foreign goods so imported are being sold or offered for sale in the United Kingdom at prices which are below the prices at which similar goods can be profitably manufactured in the United Kingdom.

(4) Whether by reason of the severity and extent of such competition, employment in the manufacture or production of such goods in the United Kingdom is being, or is likely to be, seriously affected.

(5) Whether such exceptional competition comes largely from countries where the conditions are so different from those in this country as to render competition unfair. Competition for the purpose of such inquiry is not to be deemed unfair unless it arises from one or more of the following causes:

- (a) Depreciation of currency operating so as to create an export bounty.
- (b) Subsidies, bounties, or other artificial advantages.
- (c) Inferior conditions of employment of labor, whether as respects remuneration or hours of employment, or otherwise obtaining amongst these persons employed in the production of the goods in question, as

compared with those obtaining amongst persons employed in the production of similar goods in the United Kingdom.

In making their report upon the alleged unfairness of competition, the committee may call attention to any special circumstances by reason of which, in their opinion, the industry of the United Kingdom is placed at a serious relative disadvantage.

(6) Whether the applicant industry is being carried on in the United Kingdom with reasonable efficiency and economy.

(7) Whether the imposition of a duty on goods of the class or description in question would exert a seriously adverse effect on employment in any other industry, being an industry using goods of that class or description in production.

(8) Whether, having regard to the above conditions, the applicant industry has, in the opinion of the committee, established a claim to a duty; and if so, what rate or rates of duty, in the opinion of the committee, would be reasonably sufficient to countervail the unfair competition.

The appearance of this "White Paper" aroused no little opposition. It justifiably gave rise to numerous accusations that the Government was letting general protection enter through the "back door." A resolution of censure was introduced by Labor on this very issue.<sup>36</sup> But in reply, Mr. Baldwin denied that any such intentions could be inferred from the Government's action; and asserted that they were only carrying on their announced safeguarding policy.<sup>37</sup>

#### THE CONSERVATIVE BUDGET OF 1925

This policy was merely an expansion of the provisions included under Schedule II of the 1921 Safeguarding of Industries Act. In applying that Act, two committees had been appointed, one to investigate the lace industry,

<sup>36</sup> See Censure Resolution and Speech by Mr. R. MacDonald, *Parliamentary Debates*, Commons, 1925, Vol. 180, Col. 703-20.

<sup>37</sup> *Ibid.*, Col. 720-6.



and the other the silk industry. The Government received their reports just prior to the ascendancy of Labor. The Lace Committee had reported unanimously in favor of a safeguarding duty, while the Silk Committee had been divided two against two.<sup>38</sup> No action had been taken, of course, on these reports during the year of Labor rule. Now the way was clear for the safeguarding of those industries. A new Lace Committee was shortly appointed and instructed to determine if the conditions reported by the 1923 committee still obtained.<sup>39</sup> When this committee found nothing had occurred to alter the original findings, the Government offered a resolution amending its finance proposals to allow for this duty.<sup>40</sup>

As for the silk report, no new investigation was authorized. When Mr. Winston Churchill, Chancellor of the Exchequer, announced his Budget in the House of Commons, one of his most notable innovations was a sumptuary tax upon imports of silks and artificial silks, raw or manufactured.<sup>41</sup> This, however, was not the full extent of his protectionist proposals. He reestablished the McKenna duties, claiming the same reasons for their reimposition as were advanced for their original passage in 1915. He further proposed a duty on hops which he frankly declared to be baldly protectionistic. Finally, he announced that the Government intended to carry out in the completest and most precise manner all pledges which had been made at the 1923 Imperial Economic Conference.

<sup>38</sup> See Censure Resolution and Speech by Mr. R. MacDonald, *Parliamentary Debates*, Commons, Vol. 172, 1924, Col. 213.

<sup>39</sup> Board of Trade (Safeguarding of Industries), *Report of Lace and Embroidery Committees*, 1925 (Cmd. 2403).

<sup>40</sup> *Ibid.*, Vol. 184, 1925, Col. 2271-2336.

<sup>41</sup> See Budget Speech, *Ibid.*, Vol. 183, 1925, Col. 66-70.

All of these protectionist projects were incorporated into the Finance Bill of 1925 as it was ultimately passed.

#### THE NEW SAFEGUARDING OF INDUSTRIES POLICY IN PRACTICE

According to the original safeguarding proposals, any duties suggested, if approved by the Board of Trade and the Treasury, were to be included in the Finance Bill; and with the passage of that act, legislation was evidently to be closed until the next finance measures of the following year.<sup>42</sup> Applications, of course, could be received in the meantime and investigations could be made of the applicant industries. This is what actually took place in the latter half of 1925. A number of industries applied for safeguarding protection, including those concerned with the production of such commodities as superphosphates; brooms and brushes; leather and fabric gloves; cutlery; packing and wrapping paper; gas mantles; and aluminum hollow-ware.<sup>43</sup> Of this group, the applications of the superphosphate industry, the broom and brush industry, and the aluminum hollow-ware industry were rejected. The others were favored with varying rates of duties by their investigating committees. Leather and fabric gloves, for instance, were recommended to receive a  $33\frac{1}{3}$  per cent duty, as was also cutlery. Packing and wrapping paper, however, was only recommended to re-

<sup>42</sup> Board of Trade, *Safeguarding of Industries, Procedure and Enquiries*, op. cit.

<sup>43</sup> See the following reports of the Board of Trade on Safeguarding of Industries; *Report of Superphosphates Committee*, 1925 (Cmd. 2475); *Report of Committee on Brooms and Brushes*, 1925 (Cmd. 2549); *Report of Committee on Leather and Fabric Gloves and Glove Fabrics*, 1925 (Cmd. 2531); *Report of Committee on Cutlery*, 1925 (Cmd. 2540); *Report of Committee on Packing and Wrapping Paper*, 1925 (Cmd. 2539); *Report of Committee on Gas Mantles*, 1925 (Cmd. 2533); *Report of Committee on Aluminum Hollow-ware*, 1925 (Cmd. 2530).

ceive a duty of about half that amount, 17½ per cent, to be precise, while gas mantles were recommended to receive a flat duty of six shillings per gross.

Following these recommendations, the Government determined to take steps for their immediate application. Hence, instead of awaiting the introduction of the Budget to make provision for them, resolutions were promptly moved in the House of Commons (December 2 and 3, 1925) making the duties upon cutlery, gloves and gas mantles effective at once.<sup>44</sup> The resolutions were readily passed with large majorities, though not without strenuous debate upon the general question of protection, and upon whether or not the Conservatives were breaking their election pledge. Gradually, it was claimed by the opposition in this debate, the Government was involving the country in a widespread program of protective tariffs. Where, they asked, was the Government going to draw the line in its safeguarding policy, demarcating it from a policy involving a general protective tariff?

The answer was not long in coming from the Government. A few days after the House of Commons had passed the third reading of these resolutions, Mr. Baldwin announced that an application for safeguarding protection had been refused the iron and steel industries.<sup>45</sup> The reason was, he said, that the repercussion of such protection would have been so far-reaching as to practically set up a general protective tariff in violation of his election pledge. The situation was so serious, however, according to his statement, that, had they been able to consider the iron and steel trades in isolation, the case would have been considered complete.

### THE BUDGET OF 1926

The Government, however, did not intend this to denote a relinquishing of its safeguarding policy, nor to suggest that it had any intention of modifying its policy. Later developments clearly evidence that the Ministry was fully determined to continue its pursuit. A committee, appointed to investigate the wisdom of maintaining Schedule I of the Safeguarding of Industries Act of 1921 (relating to the so-called "key" industries), reported favorably.<sup>46</sup> In fact, they recommended its reestablishment for a period of from five to ten years; its extension to a few additional articles; the increase of the duty rate in the case of optical glass and instruments; and exemption from duty by special Board of Trade order after application and investigation.

At the same time, two safeguarding reports failing to recommend duties were made public, one on worsteds and woolens, and one on enameled hollowware.<sup>47</sup> The first one was by far the more significant, for such a grant would have extended safeguarding to one of the important staple industries. Only one requisite was found lacking; i.e., unemployment. The report acknowledged, however, that sentiment was not unanimously in favor of a duty throughout the industry, the woolens group being strenuously opposed. Nevertheless, the committee was so sympathetic to the pleas of those who desired protection that it did recommend a small tariff of 12½ per cent in case future conditions should change so as to make it expedient.

Mr. Churchill's Budget Speech of 1926 followed in the train of this protectionist movement.<sup>48</sup> He proposed

<sup>46</sup> *Board of Trade Journal*, Vol. 116, pp. 476-7.

<sup>47</sup> *Ibid.*, pp. 477-8.

<sup>48</sup> *Parliamentary Debates*, Commons, 1926, Vol. 194, Col. 1687-1709.

<sup>44</sup> *Parliamentary Debates*, Commons, 1925, Vol. 188, Col. 2273-2474 and 2567-2698.

<sup>45</sup> *Ibid.*, Vol. 189, Col. 1945.

to meet the recommendations of the committee which had considered Schedule I of the Safeguarding Act by re-enacting its provisions for ten years, raising at the same time, the duties on optical glass and instruments to 50 per cent. In addition, he accepted the request to safeguard wrapping paper by imposing a duty of  $16\frac{2}{3}$  per cent; re-imposed the silk duties, and extended the McKenna duties on motor vehicles from passenger to commercial cars.

Finally, he requested Parliament to pledge the maintenance of existing preferences for ten years, thus making, as he argued, for stability. The Finance Bill as passed included these provisions. Plainly, the Conservative Government did not intend to relinquish its tariff program yet. Every opportunity to advance its cause was being utilized. Safeguarding was the chosen means, selected by that Government to secure its ends, and, at the same time, avoid the broad issue of general protection.

#### THE IMPERIAL CONFERENCE OF 1926

The meeting of the 1926 Imperial Conference is another event of significance in our record of Britain's protectionist trend. With the story of the last Conference freshly in mind, we approach this one for more evidence of the unremitting pressure which had been forthcoming from this source for closer commercial relations through preference. On the whole, we find this Conference less concerned with the problem than any of the previous ones. Apparently, it deliberately avoided the preference question, content with the approval by the Crown of present fiscal policies. On the other hand, absorbing political questions which demanded the attention of the session may have obscured it as an issue. The Empire was foundering upon the rocks of dominion nationalism. New constitutional defi-

nitions of status, therefore, engrossed the main consideration of the Conference.<sup>49</sup>

Due respects were paid, nevertheless, to the importance of preference as a stimulator of Empire trade. Mr. Baldwin, in his address at the opening of the Conference, expressed his confidence that preferences had increased the flow of inter-Imperial commerce.<sup>50</sup> In the series of responses delivered by the visiting dominion ministers, assertions were strongly in favor of it, and many pleas were made for its extension.<sup>51</sup> The members were taking this opportunity to press home their appreciation of an advantage gained in British markets by this policy. Mr. Bruce of Australia, in particular, whom we recall as so ardent a proponent of preference at the preceding Conference, sang its praises with extreme enthusiasm, pointing out the increase in trade between Australia and the rest of the Empire since its adoption. He again urged duties and preference by the United Kingdom on those foods and raw materials which could be so abundantly produced in the Empire. In this sentiment he was supported by other members.

Other economic problems were not without consideration. There had been at work since the preceding Conference several permanent Imperial organizations; for example, the Imperial Shipping Committee, the Imperial Economic Committee, the Imperial Institute, later amalgamated with the Imperial Mineral Resources Bureau, the Imperial Forestry Institute, and the newly established Empire Marketing Board. The efforts of these or-

<sup>49</sup> See the *Report of the Committee on Inter-Imperial Relations* in *The Times* (London), Nov. 22, 1926.

<sup>50</sup> See the opening address of Mr. Baldwin, *ibid.*, Oct. 20, 1926.

<sup>51</sup> *Ibid.*, Oct. 23, 1926.

ganizations and the reports compiled by them advantageously supplanted the more formal resolutions of the Imperial Conferences, in bringing about closer commercial relations between the Empire's constituent states. As an illustration, the Merchandise Marks Bill, intended as a subtle preference scheme, had been designed by the Imperial Economic Committee, and was wending its way through Parliament at this very time.<sup>52</sup>

Institutions and organizations of this kind making for closer Imperial relations were being established, reënforcing with definite proposals and research into facts, the formal declarations of the Conferences. They may be looked at from two points of view; first, as a means of temporarily avoiding further insistence on preference by the dominions; second, as sincere and genuine steps in coöperation which might lead to greater stimulation of the Imperial movement, and consequently, of Imperial preference. The possibilities of the latter being the case loom large in the light of the movement as we have traced it in our study. That preference failed to occupy its usual place in the center of the stage at the Conference can hardly be regarded as evidence of weakening importance.<sup>53</sup>

Its absence, moreover, may be explained from another point of view. Simultaneously with the opening of the Imperial Conference of 1926, there was published a plea for international economic freedom signed by a conspicuous group of bankers and business men of the United Kingdom and other European countries, with one or two signers

from the United States.<sup>54</sup> The manifesto urged that sight had been lost of the common economic interests of the world. Further world recovery was being materially delayed by the existence of trade barriers. Whatever its purposes, or however opportune its publication may have been, probably the nature of this manifesto had a salutary effect upon the existing spirit of protectionism. Moreover, it must have had its echoes in the Conference chambers. Indirectly, and in spite of a Government of professed protectionist sympathies, the supporters of free trade raised their voices in a timely statement subtly reminding the colonial delegates of Great Britain's peculiar position with regard to Continental and world trade. The forces of free trade were not impotent, and their strategy may have forestalled further steps toward preferential protection at this 1926 Conference. Had there been such steps, an election upon the issue might have been precipitated.

#### PROTECTION IN 1927 AND SOME FURTHER COMMENTS

While several safeguarding investigations have been conducted since the passage of the 1926 Finance Bill, *e.g.*, into industries manufacturing hosiery and knitware, tableware of translucent and vitrified pottery, and leather bags and metal fittings, only one of these succeeded in securing a safeguarding duty. In Mr. Churchill's 1927 Budget Speech, provision was made for a 28 per cent duty upon translucent and vitrified pottery with an Empire preference of one-third.<sup>55</sup> Mr. Churchill's protectionist innovations were not confined to one, however. He also ex-

<sup>52</sup> Imperial Economic Committee, *First Report*; "Marketing and Preparing for Markets of Foodstuffs in the Overseas Parts of the Empire," 1925 (Cmd. 2493), pp. 6-7.

<sup>53</sup> For example, the General Economic Subcommittee on Empire Films recommended ample preference upon cinema films produced in the Empire, *The Times* (London), Nov. 20, 1926.

<sup>54</sup> *Ibid.*, Oct., 25, 1926.

<sup>55</sup> See Budget Speech quoted in *The Times* (London), April 12, 1927, pp. 8-9. Also a summary of Budget provisions in the *Board of Trade Journal*, Vol. CXVIII, p. 414.



tended the McKenna duties to tires, which action, he declared, would give the Liberal Party an excuse for continued existence. In addition, he made provision for the inclusion of non-standard cinema films in the McKenna film duty. For revenue purposes, he increased the duties on matches, unmanufactured tobacco, and wines, making in this latter case, provision for Empire preference both in the actual amount of the duty and in the amount of alcoholic content.

One wonders where this method of protection by safeguarding may ultimately lead. So far as the extent of its application goes, the number of workers employed in industries granted safeguarding duties upon Board of Trade recommendations is roughly, as judged by the reports of the investigating committees, about 83,500, not a large number relative to the total number of British workers. A much larger number, roughly 425,000, are employed in industries protected by McKenna duties.<sup>66</sup> Consistent progress on safeguarding may enlarge this number considerably. If the industries protected under Schedule I as "key" industries, are considered, the number of workers in protected industry is further increased by several thousand.<sup>67</sup>

Opposition of a very keen sort naturally has arisen against the extension of protection. Nevertheless, the Conservative Party has had an adequate majority to carry through its policy of safeguarding. Moreover,

<sup>66</sup> A statement of the number employed in these industries by the Board of Trade, exclusive of tires, as of July, 1925, occurs in the *Parliamentary Debates*, Commons, Vol. 198, Col. 3017.

<sup>67</sup> Probably to a figure of not more than 600,000. This rough estimate is based upon the figures referred to in the foregoing note, and upon a review of the statistics on the number of people engaged in various industries, as of June, 1921. See Committee on Industry and Trade, *Survey of Industrial Relations*, 1926, pp. 403-15.

they have passed the Merchandise Marks Bill, which, upon complaint to the Board of Trade and an affirmative order from it, requires competing goods to be marked as to the country of origin.

In all of these steps, the Government has moved with caution. Yet political antagonists have accused them many times of breaking their pledge to the people. Also, industries affected adversely by the safeguarding policy because the protected industry stands in such a relation to them that their own pecuniary interests have been involved, have been active opponents before the Board of Trade and its investigating committees. As a matter of fact, it is difficult to see from the reports of such committees that adequate scientific evidence has been compiled to establish protection.<sup>68</sup> When we recall the terms of the Government's instructions to them, however, it is conceivable that they have acted fairly in their recommendations.

So much for the course of protection up to the time of writing. We suggested in the concluding paragraph of the previous chapter that the movement might prove to be a temporary one, yielding gradually with the return of peace time conditions. That such a

<sup>68</sup> Prof. T. E. Gregory writes that in no instance has a case for protection been proven. Wrapping paper, he points out, was granted protection on a 5 per cent increase of imports over 1913, which increase is accounted for by the increase in the use of kraft paper, a special paper made abroad and only slightly manufactured in the United Kingdom. Furthermore, this duty was urged by the committee as an experiment. Another industry, making gas mantles, was given protection merely on the plea of national importance. Low wages or unfair competition have been asserted without substantiation of reasonable data. We concur with Professor Gregory, after examining the available published reports, that it appears largely chance whether an industry gets protection or not. See his article, "Tariff Disorders on Their Merits," *Manchester Guardian Commercial*, *Annual Review of 1925*, p. 20.



readoption of a free trade system has not taken place the events narrated in this chapter abundantly disclose. Speculation about the future possibilities of protection in Great Britain, consequently, would not be without justi-

fication at this point. Let us refrain from it, however, until we have examined the fundamental economic forces at work throughout the whole period. To this task the next two chapters are devoted.

## CHAPTER IV

### GREAT BRITAIN'S PRE-WAR ECONOMIC STATUS AND THE MOVEMENT TOWARD TARIFF PROTECTION

HAVING traced the outward manifestations of the movement for tariff reform up to the present time, we must turn now, as just suggested, to a review of industrial and trade developments in order to gain a complete picture. It will be recalled that we noted the rapid expansion of British trade from 1850 on, and the subsequent slowing up after 1868, which date marks the beginning of a series of movements for tariff reconstruction. A large number of forces, beyond a doubt, were highly influential in shaping the origin and evolution of such movements. Of these forces, none were more important than pecuniary considerations. That is to say, the economic actions of individuals, and hence, of groups, are determined in large measure by their immediate interest in connection with particular bargains. Trade conditions tend to be the barometer of the economic interests of the majority. They are, therefore, especially revealing for our analysis.

#### EXPORT TRADE BEFORE 1900

While it is not our intention to write a complete analysis of British trade from 1850 to the present time, it does seem desirable for the reader to possess some concept of what changes had taken place during the fifty years prior to the period which it is our intention

to describe more carefully. In order to obtain a graphic perspective, Chart 1 has been prepared with the data carried through from 1850 to 1902.<sup>1</sup> In the latter year began the great political struggle for the modification of the free import policy, under the leadership of Mr. Joseph Chamberlain. Export data have been used because they are regarded generally as reliably representing British economic conditions, that country being so predominantly a trading nation. Because of the striking price changes which took place during this period, it has been found desirable, in order to eliminate this disturbing element, to divide the raw figures for each year with the corresponding Sauerbeck Index Number of wholesale prices, the base being an average of prices from 1867 to 1877.<sup>2</sup>

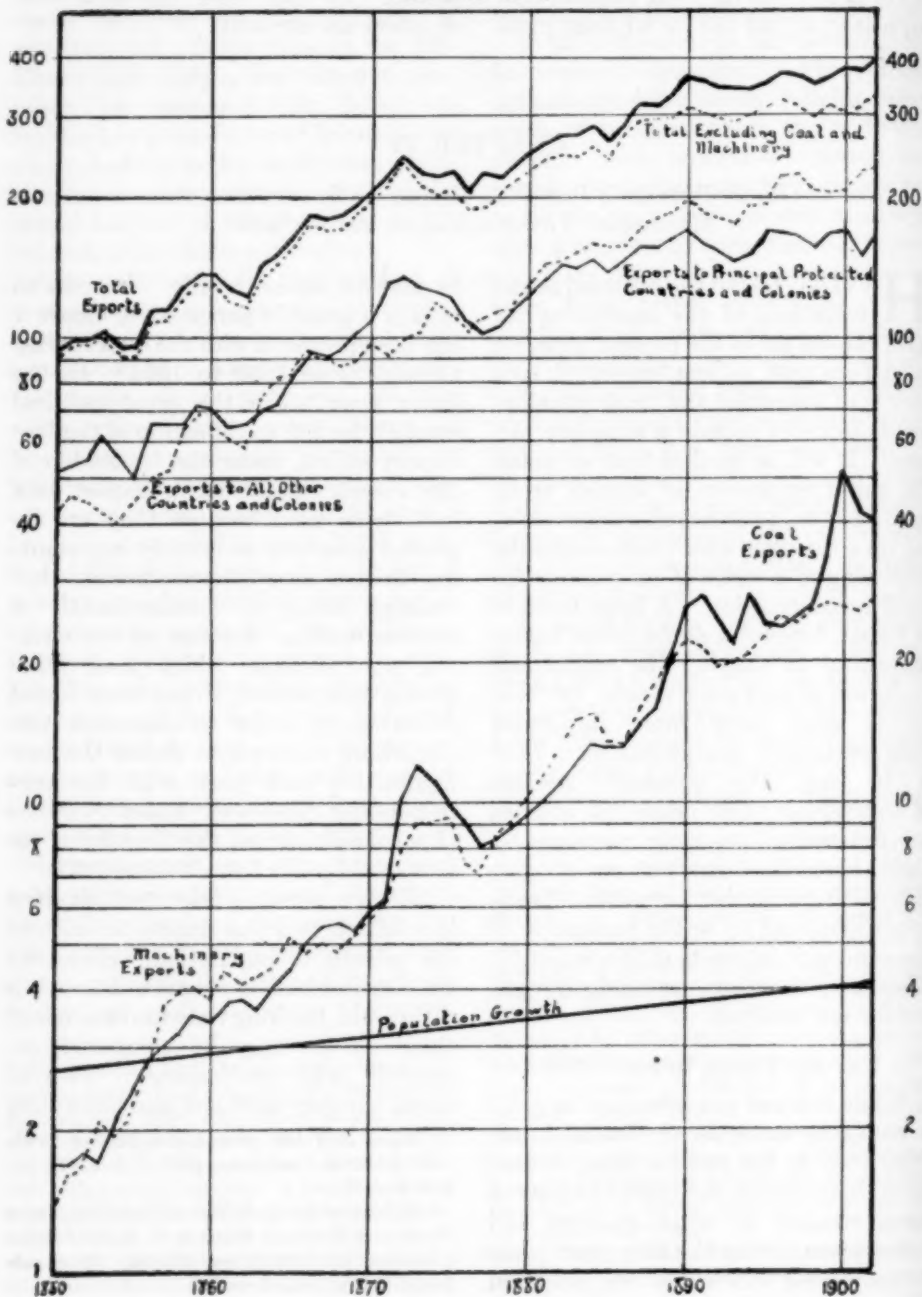
We have given on this chart, six lines in addition to a line drawn to indicate the growth of population. Since the scale upon which the chart is drawn is a ratio scale, the long time movements of these curves may be compared accurately with one another. Two of them, the curves of *coal* and *machinery*

<sup>1</sup> Board of Trade, *British and Foreign Trade and Industrial Conditions*, 1903 (Cd. 1761), pp. 18-9 and 97.

<sup>2</sup> Bulletin of the U. S. Bur. of Lab. Sta., *Index Numbers of Wholesale Prices in U. S. and Foreign Countries*, 1921 (284), pp. 275-81. Prices adjusted by the present writer.

CHART 1—INDICATING THE TREND OF BRITISH COAL, MACHINERY AND TOTAL EXPORTS TO ALL DESTINATIONS; AND OF TOTAL BRITISH EXPORTS TO THE PRINCIPAL PROTECTED COUNTRIES AND COLONIES AND TO ALL OTHER DESTINATIONS, IN EACH YEAR, 1850-1902

(Adjusted values used. Logarithmic vertical scale.  
Unit: £1,000,000)



exports, included here because of their growing importance as exports in this period, show a fairly steep and constant rate of growth for the entire period; that is, their secular trends could best be described by a straight line. For the curves, *all other products* and *total exports*, the trends could best be described by rising lines with a diminishing rate of ascent. Thus, they show for the whole period an increase, but the rate of growth is seen to be decreasing, indicating that the expansion of British trade was meeting with increasing resistance. The rate of growth, however, is still observed to be in advance of population. The rapid rate of growth in coal and machinery exports was at times the basis of economic pleas for tariff reform. A continuation in the growth in the latter classes of exports, it was urged, indicated an early exhaustion of Britain's basic resources, as well as increasing foreign industrialization; while a decrease in the former revealed that she was hardly maintaining her position in world trade.<sup>3</sup> Dire prophecies, consequently, were made concerning the future of British trade.

The trends of the other two curves, which show the data of *total exports* of British produce to the *principal protected countries and colonies*,<sup>4</sup> and to *all other countries and colonies*, were likewise the cause of some concern to observers.<sup>5</sup> It is evident from the curves that a very pronounced change in the direction of the export trend to

the *principal protected countries and colonies* took place after 1872.<sup>6</sup> That is to say, although trade with these countries from that year on continued to increase, the fluctuations were violent, and the rate of long-time growth was greatly decreased, tending to become less than that of population. Export trade to *all other countries and colonies*, on the other hand, increased at a much greater rate, though even here it tended to diminish. This shift, perhaps, may be further illuminated by the use of percentage figures.<sup>7</sup> In 1850, 56 per cent of the exports of all articles of British produce were shipped to those countries designated as *principal protected countries and colonies* and in 1870, 53 per cent, while in 1902, only 42 per cent. Correspondingly, the exports to *all other countries and colonies* increased from 44 per cent in 1850 to 47 per cent in 1870 and 58 per cent in 1902. When only exports of manufactured produce are considered, the former figure fell from 57 per cent in 1850, to 38 per cent in 1902, while the latter rose from 43 per cent in 1850 to 62 per cent in 1902. In addition, the proportion of manufactured exports to total exports was falling in this same period from 96 per cent in 1850 to 75 per cent in 1902 for the *principal protected countries and colonies*, and from 91 per cent in 1850 to 87 per cent in 1902 for *all other countries and colonies*.

#### IMPORTS BEFORE 1900

Further information concerning the shifts which had occurred in trade may be gleaned by considering net imports.<sup>8</sup> On the whole, they grew almost con-

<sup>3</sup> Ashley, *op. cit.*, pp. 259-63.

<sup>4</sup> The *principal protected countries and colonies* include Russia, Germany, France, Belgium, Holland, Spain, Portugal, Italy, Austria-Hungary, United States, Canada and Victoria. Belgium and Holland are included because a large part of their imports pass on into Germany. See Board of Trade, *Report on British and Foreign Trade and Industrial Conditions*, 1903 (Cd. 1761), p. 13.

<sup>5</sup> Cunningham, W., *The Rise and Decline of the Free Trade Movement* (Univ. Press, Cambridge, 2nd ed.) pp. 107-8.

<sup>6</sup> In interpreting these curves, the reader is cautioned to keep in mind that boundary changes, especially from the expansion of the British Empire, have had an important influence on the figures.

<sup>7</sup> Board of Trade, *British and Foreign Trade and Industrial Conditions*, *op. cit.*, pp. 16-7.

<sup>8</sup> *Ibid.*, pp. 99-104 and 403-4.

stantly during the period. On the other hand, imports for reëxport purposes indicated a much lower rate of growth for the twenty-five years prior to 1890 and practically no growth after that date.<sup>9</sup> Apparently, since exports tended to increase at a diminishing rate, a great increase in the invisible items entering into trade was occurring in these latter years to enable payment for the large imports. In other words, although Great Britain was still predominantly industrial, her imports were being paid for more and more by means of the income from financial, commercial and shipping transactions of all sorts. Moreover, the continual growth of imports was being constituted each year of a larger proportion of manufactured goods, amounting, for example, to 11 per cent of the net imports in 1860 and 25 per cent in 1902. That is to say, other countries were offering more and more of their manufactures in exchange for British manufactures and services; whereas formerly they had offered mainly foods and raw materials.

This change could work no ill effects upon British trade in itself, providing sufficient foods and raw materials were imported from the same or alternative sources, the manufactured goods being in excess of the essentials for sustaining a growing industry. But when we consider more closely the possible nature of the increased importations of manufactured goods, an element of friction appears. In many cases, they probably consisted of desirable goods not generally produced in Great Britain, or at least, more cheaply abroad. In some cases, the importations were doubtless variations and refinements in the quality of common products, not duplicated by British manufacturers. When such conditions obtained, there was a sound basis for the existing system of trade.

<sup>9</sup> Falling from 12 per cent of total imports in 1854 to 10.6 per cent in 1902.

There may have been in many instances, however, and probably were, manufactured goods imported of an actively competitive nature. When this occurred, and where such competition was felt, the friction which the British economic machine ordinarily encountered without necessity of adjustment was manifoldly increased. In such fields, the soil was fertile for the germination of the seeds of protection such as bloomed in the Chamberlain campaign.

#### BRITISH FOREIGN TRADE FROM 1900 TO 1914

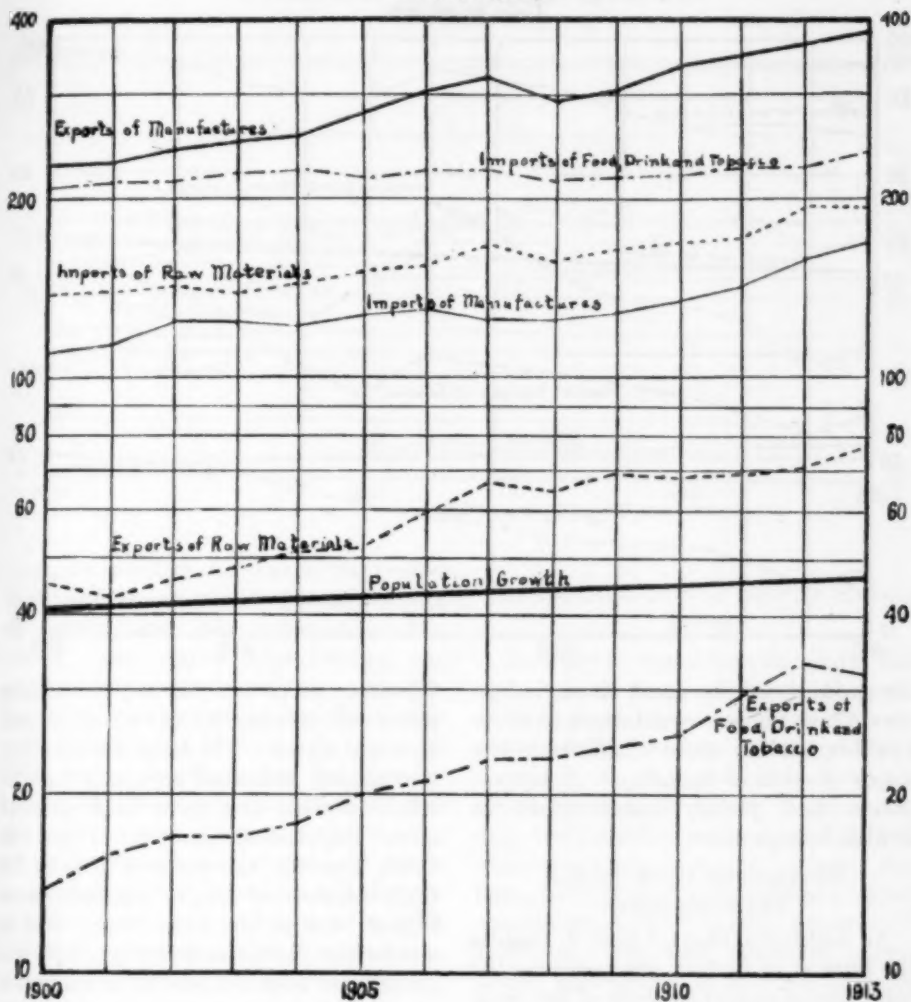
Subsequent developments in British foreign trade throw additional light on an understanding of the tariff reform movement during the immediate pre-war period. The general character of that trade may be seen in Chart 2, which shows the annual net imports and total exports of United Kingdom produce, divided into classes, adjusted values being used with 1900 as a base.<sup>10</sup> For example, the trend of imports of the *food, drink and tobacco* curve, it is seen, accords closely with the line of population growth. Exports of this class, however, increased faster than did population, and may be accounted for by the increased exportation of manufactured foods, excluded from classification as manufactured goods because of food qualities. Relative to the total this class is small.

Again, imports of *raw materials and articles mainly unmanufactured* show a greater rate of increment than population, indicating industrial gains. Exports of this class, on the other hand, consisting largely of coal, show a diminishing rate of growth after 1909, but this diminution did not fall below that of population for the remaining period.

<sup>10</sup> Adjusted by the Board of Trade. See its memorandum, *Imports and Exports at Prices of 1900, 1914* (Cd. 7432), pp. 30-1.

CHART 2—SHOWING THE NET IMPORTS AND TOTAL EXPORTS OF BRITISH PRODUCE, DIVIDED INTO CLASSES, IN EACH YEAR, 1900-13

(Adjusted values used. Logarithmic vertical scale.  
Unit: £1,000,000)



The curves of exports and imports for the third class of goods, *i.e.*, *articles wholly or mainly manufactured*, are especially interesting, for over one-fourth of the total value of the 1913 imports, and over three-fourths of the total value of the 1913 exports were included in this class. The course of the imports reveals a consistent upward swing for the entire period, with deflec-

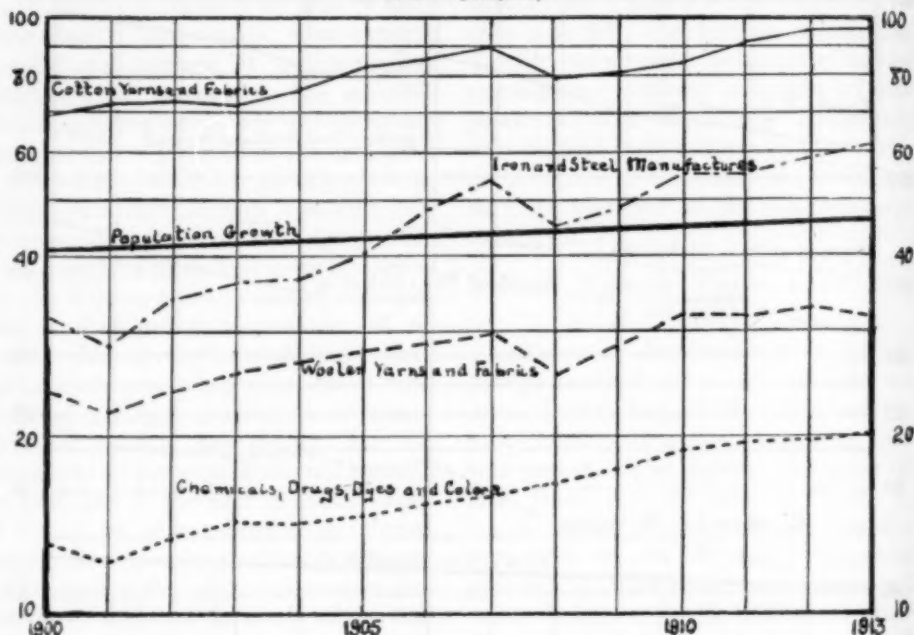
tions occurring in the years 1907, 1908 and 1909. The rate of growth is much greater than the rate of population growth. The exports curve (for this class), while fluctuating considerably from year to year, also reveals a steady upward trend, apparently, at a greater rate of increase than is indicated by the imports curve. Since the exports of this class of goods are made largely of



CHART 3—SHOWING BRITISH EXPORTS OF (1) IRON AND STEEL MANUFACTURES; (2) COTTON YARNS AND FABRICS; (3) WOOLEN YARNS AND FABRICS; AND (4) CHEMICALS, DRUGS, DYES AND COLORS, IN EACH YEAR, 1900-13

(Adjusted values used. Logarithmic vertical scale.

Unit: £1,000,000)



the products of the great staple industries, these figures would seem to show a rather healthy state of affairs in the major portion of industry. A rejuvenation had plainly taken place in British foreign trade.

#### EXPORTS OF FOUR STAPLE MANUFACTURES

An additional chart, Chart 3, enables the pursuit of further analysis into the condition of exports of four of the great staple industries.<sup>11</sup> The four principal groups of articles (*mainly or wholly manufactured*) representative of these staple industries are: (1) *iron and steel*;

<sup>11</sup> Board of trade, *Imports and Exports at Prizes of 1900*, op. cit., pp. 36-7. These values likewise have been adjusted for prices by the Board of Trade.

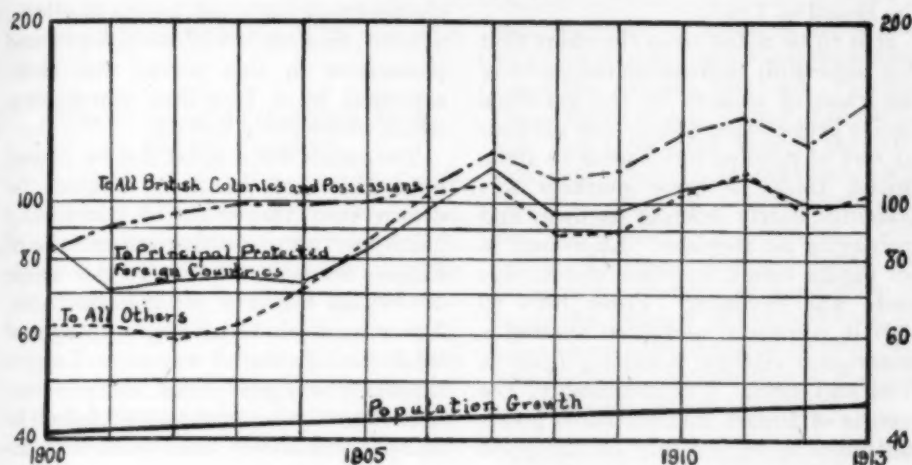
<sup>12</sup> Producers in the iron and steel and woolen industries, it will be recalled, were in favor of protection in the war period. See above, pp. 205-206.

(2) *cotton yarns and fabrics*; (3) *woolen yarns and fabrics*; (4) *chemicals, drugs, dyes and colors*. The trend for the first two named increased regularly for the whole period, and were both greater than population growth. Prior to 1907, however, the rates of growth for both classes of staple exports were higher than in the later years; and in the former years the rate of growth was greater for *iron and steel* than for *cotton yarns and fabrics*, while in the later years, the growths were approximately the same. Of the other two curves, the one representing exports of *chemicals, drugs, dyes and colors*, increases consistently for the entire number of years.<sup>13</sup> This is especially interesting

<sup>13</sup> According to British official opinion, the progress of the chemical industries in the pre-war period was very limited. See quotation, *infra*, pp. 73-74.

CHART 4—SHOWING THE DISTRIBUTION OF BRITISH MANUFACTURED EXPORTS BETWEEN THE PRINCIPAL PROTECTED FOREIGN COUNTRIES; ALL DOMINIONS; COLONIES AND POSSESSIONS; AND ALL OTHER DESTINATIONS, IN EACH YEAR, 1900-13

(Adjusted values used. Logarithmic vertical scale.  
Unit: £1,000,000)



when we recall that it was in this period that the German chemical industry was developing into the greatest in the world. The curve representing exports of *woolen yarns and fabrics* reveals the least healthy condition. While the rate of accession, for example, prior to 1907, is greater than that for population, after the depression of 1907 and the recovery of 1908 and 1909, the curve levels off, and shows neither a marked decline nor incline for the remaining four years. Apparently, this industry was having difficulties in maintaining its export position.<sup>14</sup>

<sup>14</sup> It is to be noted that the present writer has made no effort to make a comparative study of the exports of Great Britain's staple industries and those of other great industrial nations, and to prove thus the comparative decline of Great Britain, as is often done; i.e., Drage, *op. cit.*, Chapter 4, and Hewins, *op. cit.*, Chapters 8 and 9. The writer is not convinced that such discussion is at all fruitful, or that such comparisons prove anything in particular, save that an industrial civilization may be acquired by almost any nation possessing the energy, intelligence and natural resources.

#### THE DISTRIBUTION OF BRITISH EXPORT TRADE

In order to appreciate the shifts that were taking place among markets for British goods, especially *protected and other markets*, we have prepared Chart 4, which, as distinguishable from the similar curves on Chart 1, gives only data for manufactured exports.<sup>15</sup> This enables a more accurate picture, perhaps, since these are the classes of goods against which tariff barriers are erected. Differing from the previous curves again, this group is divided between three, instead of two destinations, *e.g.*,

<sup>15</sup> Board of Trade, *Return Showing the Value of Manufactured and Partly Manufactured Articles (Domestic Produce) Exported from the United Kingdom*, (a) to the Principal Protected Foreign Countries; (b) to all British Colonies and Possessions; (c) to All Other Destinations for the years 1800, 1885, 1890, 1895, 1900 and for each subsequent year to 1911, etc., 1912-13 (536); p. 3. Also, *Annual Statement of Trade of the United Kingdom with Foreign Countries and British Possessions*, 1913, Vol. II, 1914 (Cd. 7585), pp. 20-5.

(1) *the principal protected foreign markets*; (2) *all British colonies, dominions, and possessions*; (3) *all other destinations*. The values used have been adjusted on 1900 as the base year by the Board of Trade.

It is to be noted from the chart that it is impossible to describe the curve of this class of exports to the *principal foreign protected markets* by any particular sort of upward trend prior to 1904. British trade to these markets was evidently barely holding its own, and registering no increase. Expressed in per capita terms, in other words, this trade was declining. From 1904 to 1907 it recovered and even showed a remarkable vitality, slumping again in 1908 and 1912. Unquestionably, the exports of British manufactured goods continued to be severely handicapped by tariff barriers, as well as by the competing industrial technique which was developing behind them, other circumstances being propitious.

This does not mean that tariff barriers were the sole obstacle to a larger expansion of British export trade in this period. The curve of exports to *all other destinations* indicates that this was not the case. For example, after 1904 this curve fluctuates around the curve of exports to the *principal protected foreign countries*. The extension of competition is suggested by this as becoming a factor of growing importance. For the entire period there is an upward trend observable at a somewhat greater rate than that of population growth. Severe fluctuations tend to conceal it. These markets were patently very erratic absorbers of British manufactured goods.

Turning to the third curve, that of exports to *British dominions, colonies and possessions*, we see the most consistent trend of all. It will be recalled that the self-governing dominions were engaged in altering their tariff systems

during this period. In some cases increasing barriers were erected, but, at the same time, preferences were being granted and extended to British manufacturers. Whatever the effects these changes may have had, we may believe, at least, that trade with *the colonies and possessions* in this period was characterized by a long-time consistency which other trade lacked.

Too much stress must not be placed upon this fact, however, lest we be drawn into the error of concluding hastily as to the growing importance of Empire trade in relation to the whole of British exports of manufactures. Nevertheless, in terms of percentages of total manufactured exports, Empire exports which grew from 35.8 per cent in 1900 to 41.8 per cent in 1903, fell off to 35.2 per cent in 1906, from which percentage they gradually rose until in 1913 they amounted to 42.2 per cent of the total.<sup>10</sup> Those to *all other destinations* acted in an opposite fashion, being 27.3 per cent in 1900, reaching 33.2 per cent in 1906 and subsequently declining to 29.5 per cent in 1913. Manufactured exports to *principal protected foreign countries*, furthermore, falling sharply from 36.9 per cent in 1900 to 31.7 per cent in 1901, tended to retain a fair stability around this figure until 1910, when they again fell off, reaching 28.3 per cent in 1913. Thus, while the percentage changes were not extremely marked, with allowances for the year to year shifts, it does appear reasonable to conclude that they thoroughly substantiate our previous conclusions. Empire trade throughout the period was slightly the largest proportion of the total trade as against trade with the principal protected markets and trade with all other markets. Finally, in terms of annual averages, the Empire

<sup>10</sup> These figures have been compiled from the data contained in the Board of Trade *Return*, *Ibid.*

trade of these fourteen years was much higher than that of the ten years previous, the average annual percentage of manufactured Empire exports to total exports for that decade being 33.6 per cent, while the average annual percentage from 1900 to 1913 was 38.8 per cent.

#### UNITED KINGDOM IMPORTS FROM EMPIRE SOURCES

Because of the understanding such analysis as the foregoing adds to the full comprehension of the momentum gained by the preference movement in the pre-war era, it seems desirable to pursue it even further. For example, the question arises at this juncture whether or not Great Britain was becoming increasingly dependent upon the colonies and possessions for her food and raw materials. An answer to this may be found by analyzing net imports from Empire sources as percentages of total net imports.<sup>17</sup>

Total net imports of all Empire produce increased from 21 per cent in 1900 to 25.2 per cent in 1910, dropping to 25 per cent in 1912. This increase is accounted for entirely by an increase in imports of food, drink and tobacco. Empire products were 19.2 per cent of the total of that class of imports in 1900, and, after a more or less regular climb, were 28.6 per cent in 1912. On the other hand, Empire raw materials as a percentage of all imported raw materials contained a very small, if any, element of growth, the percentage tending to fluctuate about its average of 29.1 per cent. A similar tendency is evident for imported Empire manufactures as a percentage of total manu-

factured goods, which fluctuated about its average of 11.7 per cent.

Such a change holds considerable interest for us in our analysis. Though Great Britain did not suffer any increased dependence on the Empire for raw materials or manufactures, there was a marked increase in her dependence upon the Empire for food. Whether dependence on the former increased or not, it is significant enough that these classes of imports remained stable while the proportion of food imports from Empire sources had increased. Great Britain's unique industrial system with its highly concentrated population had made the problem of securing food supplies an equally, if not more vital problem to that of obtaining raw materials for her manufacturing operations.

#### IMPORTS AND EXPORTS OF THE EMPIRE

In order to obtain still another slant upon the problem, let us seek an answer to the question: Were the various members of the Empire growing more or less dependent upon the United Kingdom and upon each other? A brief answer may be obtained by treating in summary fashion the exports of all British dominions, colonies, possessions and protectorates with regard to their destinations, and their imports with regard to their source. For greater clarity, percentage figures of total exports and total imports will be used. While the data are not sub-classified, exports consisted mainly of raw materials and food, and imports were made up largely of manufactured goods.<sup>18</sup>

Considering first Empire exports in general terms, the changes in the per-

<sup>17</sup> These figures have been computed from data found in the Board of Trade, *Statistical Abstract for the United Kingdom, from 1899 to 1913, 1914-16* (Cd. 7636), pp. 166-7 and *Statistical Abstract for the British Empire, from 1898 to 1912, 1914* (Cd. 7241), pp. 97-8.

<sup>18</sup> These percentages have been computed from data taken from the Board of Trade, *Statistical Abstract for the Several British Self-Governing Dominions, Crown Colonies, Possessions and Protectorates, from 1898 to 1912, 1914* (Cd. 7165), pp. 54-5 and 60-1. (Including exports and imports of bullion and specie.)



centage distribution of these exports between the United Kingdom, the various portions of the Empire itself, and foreign countries, were not great. Take, for instance, exports to the United Kingdom: for the first six years from 1900 to 1905, the average annual share was 42.5 per cent, which figure grew to 44.1 per cent for the remaining seven years. The average annual share of the United Kingdom for the whole period was 43.3 per cent. As for inter-Empire exports, exclusive of the United Kingdom, they averaged 18.9 per cent for the first seven years from 1900 to 1906, then dropped for the remaining six years, averaging but 14.7 per cent of the total. The average annual proportion of Empire exports to foreign countries, finally, acted contrariwise from that for inter-Empire trade, being 38.5 per cent for the period 1900 to 1906 and 41.4 per cent from the latter year to 1912. On the whole, Empire trade does not appear from these figures to have grown more inter-dependent, although the slight growth in the percentage taken by the United Kingdom may be ascribed some importance for the interpretation of the preference movement. It should be remembered, however, that a similar percentage growth occurred in Empire exports to foreign countries and a decrease occurred in the proportion of inter-Empire exports.

More significant information is revealed by the treatment of imports. The imports of the Empire from the United Kingdom declined from an average annual proportion of 47 per cent for the three years, 1900, 1901 and 1902 to 40.5 per cent for the year 1912, the average annual percentage for the entire period being 44.8 per cent. Imports from Empire sources, as would be expected from our analysis of exports, also registered a decline from an average annual figure of 19.9 per cent for

the first five years to one of 16.7 per cent for the remaining eight years. The percentage imported from foreign countries, on the other hand, manifested a notable disposition to increase, rising from 33.9 per cent in 1900 to 36 per cent in 1907 and 44.5 per cent in 1912. This change in the distribution of Empire imports suggests that the colonies and possessions were becoming less dependent upon the United Kingdom, and also less dependent upon each other as time went on. This aspect must not be unduly stressed, however, because the colonies were still dependent for over 40 per cent of their export and import trade on the mother country in 1912, and this is no small percentage. Moreover, 15 per cent more of their trade was among themselves. The Empire was beyond a doubt materially inter-dependent. Yet we must not forget that the 45 per cent of their trade still unaccounted for was with foreign countries, and that this latter portion was growing rapidly, containing a probable element of increased competition for the British manufacturer. It does not seem unreasonable to conclude in the light of these and the foregoing facts of Empire trade, that certain Imperial forces, along with others, were becoming favorable to the protectionist program.

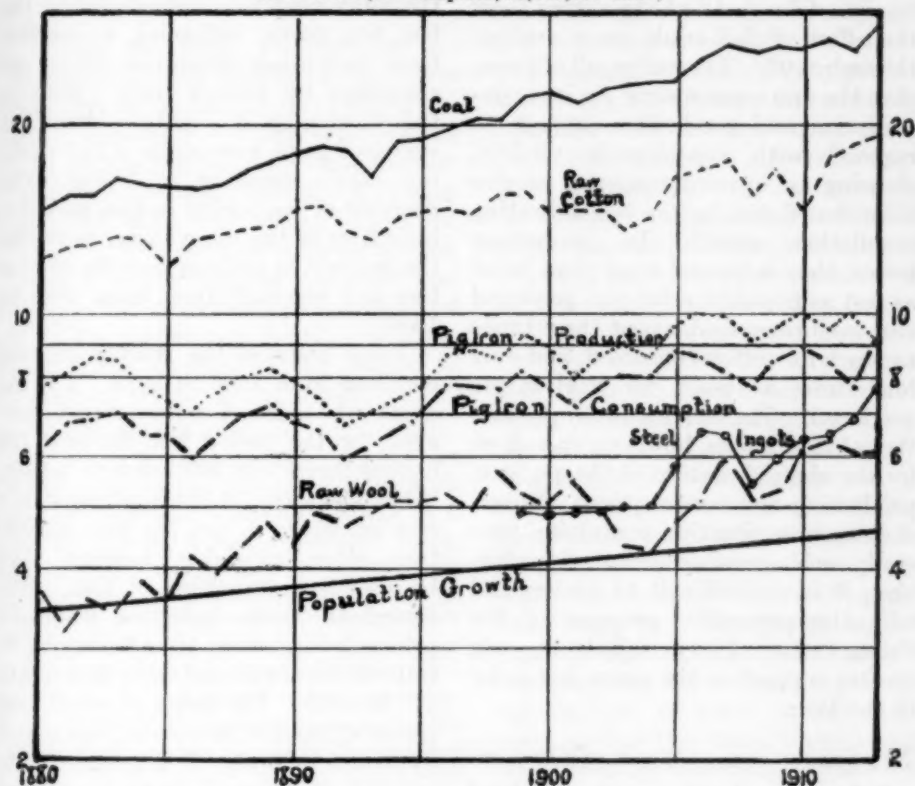
#### INDEXES OF PRODUCTION

Our analysis thus far has dealt largely with Great Britain's foreign trade as an index of her pre-war economic status. In order to round out this treatment, a brief consideration of the development of the volume of her production, as indicated by data which are commonly regarded as accurate indexes is required. Information, illuminating as to production trends of some of the large staple industries, is contained in Chart 4, which gives curves for the consumption and production of some of the primary



CHART 5—SHOWING VARIOUS SERIES INDICATIVE OF THE PHYSICAL VOLUME OF BRITISH PRODUCTION IN EACH YEAR, 1880-1913

(Logarithmic vertical scale. Unit for Coal (Production), Pig Iron (Production and Consumption), and Steel Ingots (Production): 1,000,000 tons. Unit for Raw Cotton (Consumption) and Raw Wool (Consumption): 1,000,000 cwts.)



materials of British industry.<sup>19</sup> Three of the curves, for raw cotton, raw wool and pig iron consumption, and two for pig iron and coal production are carried back to the year 1880 in order to provide a long time view. A curve for steel ingot production is added from 1899 to 1913 to make the picture of production in the iron and steel industry more complete.

The most patent long-time conclusion to be drawn from the chart is that, on the whole, the volume of production,

as revealed by these indexes, was keeping pace with the increase of population, but that it was not increasing a great deal faster. Closer observation will substantiate this inference with one exception. The long time trend of each curve from 1880, save the one for coal production, with due allowance for the numerous intermediate fluctuations, tends to be approximately parallel with that of population. The coal curve, singularly enough, displays a degree of growth somewhat greater. It will be recalled that coal exports were growing in the period before 1902 with considerable rapidity.

Taking a shorter view of the picture

<sup>19</sup> This data has been taken from the Board of Trade, *British and Foreign Trade and Industrial Conditions*, op. cit., pp. 439-47 and the *Abstract of Labor Statistics*, 1914-16 (Cd. 7733), pp. vi-vii.

from 1900 to 1913, a more detailed analysis is required because of the importance of this period in laying the foundation for the post-war protectionist edifice. All of the curves show the effect of dull trade years existing through 1903. Thereafter, all of them, save the two representing pig iron consumption and production, appear to respond with considerable vitality, showing an upward tendency greater than that shown by the line indicating population growth. In percentage terms, they increased more than twice as fast as population for coal produced and wool consumed, about three times as much for cotton consumed, and over four times as much for steel ingots produced. The increase in the production of steel ingots, however, was offset by the sluggish nature of the pig iron production and consumption. Nevertheless, in a situation containing generally such a growing volume of production, it is not difficult to understand why the protective program of the Conservative Party failed to win greater support in the years just prior to the War.

#### THE STATUS OF THE WORKER'S INCOME

Before terminating our statistical observations of pre-war Britain, it is interesting to note the drift of the worker's status. This is best revealed by indexes of his income.<sup>20</sup> According to the Board of Trade index of money wages in the principal trades (the base year being 1900) wages rose from 83 in 1880 to 100 in 1900. In addition,

<sup>20</sup> Board of Trade, *British and Foreign Trade and Industrial Conditions*, *op. cit.*, pp. 259-60. The index of money wages is an unweighted mean of the index numbers of wages in a group of the most important trades. For the index of the cost of living, see *ibid.*, 1904 (Cd. 2337), pp. 31-3. This is a weighted mean of the index numbers for food, rent, clothing, fuel and lighting, the principal items entering into the working man's budget.

the Board of Trade's index of the working man's cost of living in the large cities fell from 122 in 1880 to 100 in 1900. In the case of both indexes, the movement was slowest during the last ten years, indicating a reaction from increasing resistance being encountered by British trade. Despite this slowing up, it is quite evident that very real gains were made in the working man's standard of living. The decrease of pauperism in this period is indicative of the same thing, as is also the increase in savings deposits of over two and one-half times from 1880 to 1900.<sup>21</sup>

These gains of the worker did not continue from 1900 to 1913. For example, the index of money wages averaged for the period but 99, and the highest figure was 105, reached in 1913. While the index of the working man's cost of living is not for this period, two other available indexes may be used as suggestive of this. The Board of Trade index of wholesale prices, for instance, after falling to 97 in 1903, rose in the subsequent years to 117 in 1913. The index of retail food prices in London, moreover, rose steadily to 115 in 1913. It is reasonable to suppose that retail costs in general followed somewhat the course of wholesale prices and London retail food prices. Such being the case, with money wages remaining sluggish as they did, the working man plainly was losing some of the gains of the previous period. Moreover, the recovery of wages was being hampered by a large percentage of unemployed in many years. Savings deposits increased 14 per cent.,<sup>22</sup> nevertheless, and pauperism decreased 17 per cent.<sup>23</sup> On the whole,

<sup>21</sup> *Ibid.*, 1903 (Cd. 1761), pp. 470-1 and *ibid.*, 1904 (Cd. 2337), p. 197.

<sup>22</sup> Board of Trade, *Abstract of Labor Statistics*, *op. cit.*, pp. 326-7.

<sup>23</sup> *Ibid.*, p. 330.

the working man's position was not precarious, although it was not all that could be asked.

#### A BRITISH ANALYSIS OF THE WEAKNESSES IN PRE-WAR TRADE

There are other elements in the situation besides the facts which are revealed by statistical data which demand our study. These are reviewed by the analysis of the Committee on Commercial and Industrial Policy after the War, with regard to pre-war trade.<sup>21</sup> The analysis is significant because it reveals what an important and representative British group considered to be the weakness of the pre-war situation. The portion of the report in which we are interested reads:

Whilst British industry, on the whole, had shown in the preceding decade great vitality and power of extension, its strength and development had been mainly in a certain number of long established manufactures of which coal, cotton and the textile trades generally, shipbuilding and some branches of the engineering trades (such as textile machinery) are the most conspicuous examples. One important exception must be made on this general proposition; the iron and steel trades have made comparatively little progress. . . . In the rise and expansion of the more modern branches of production, the United Kingdom had taken a very limited share; as is evidenced by our relative weakness in respect to the electrical, chemical and chemico-metallurgical industries; and it is admitted that in a number of smaller trades, foreign manufactures have shown greater enterprise and originality.

In short, British industry had failed to acquire diversity in modern development and had been content to progress along staple lines directed by the sheer force of momentum. As a result of this, distinct dangers threatened British industry as a whole, according to the report: *i.e.*, (a) certain branches of

production, of great importance as a basis for other manufactures, had come to be entirely under foreign control; and (b) foreign manufactures had secured a strong or even dominant position in numerous other branches of industry, and thus could successfully prevent the establishment of British competition.<sup>22</sup> Moreover, the concentration of her industrial risks in a limited number of staple lines increased susceptibility to trade fluctuations. British ingenuity, the inference is, had failed to fulfill its obligations and had been tactically outwitted in international economic competition.

#### SUMMARY

In order to relieve any confusion which our detailed analysis may have caused, let us briefly recapitulate. A rapid survey of British foreign trade before 1912 showed that for all British exports there was a retardation after 1870, save for coal and machinery which continued their rapid growth (see Chart 1). This growth and the trend of exports to protected and unprotected markets was the cause of apprehension in some quarters. Imports, on the other hand, showed a constant tendency to increase. Since they contained a growing proportion of manufactured goods, increasing competition must have been felt in the British home market, even allowing for manufactured imports not produced by the British themselves.

Foreign trade after 1900 suffered a few years of hesitant activity but in the

<sup>21</sup> *Ibid.* The (a) group included such industries as synthetic dyes, spelter, tungsten, magnetos, optical and chemical glass, hosiery, needles and others named in the Committee's *Interim Report on Certain Essential Industries*, 1918 (Cmd. 9032). The (b) group included such industries as glassware, brooms, and brushes, bentwood furniture and others named in *Report of Sub-Committee to Advisory Committee to the Board of Trade*, 1916 (Cd. 8181).

<sup>22</sup> *Final Report* 1918 (Cmd. 9035), p. 21.

last half of the pre-war period exhibited an encouraging capacity for expansion. Of the staple industries whose exports were examined more closely, the woolen industries made the poorest showing. Our analysis of the shifts occurring in British markets after 1900 indicated that, in protected markets, British manufactured exports were handicapped by tariff barriers and the competing industrial technique developing behind them. Other foreign markets were erratic, while Empire markets alone were consistent absorbers of British products.

In pursuit of the question of growing Empire inter-dependence as a means of illuminating the preference movement, we found Great Britain becoming increasingly dependent on the Empire for her food supply. On the other hand, the Empire was relying increasingly on other markets for export outlets and also for import sources, making increased competition for the British manufacturer. On the whole, our analysis of Imperial trade from 1900 to 1914 suggested the conclusion that forces from this source were tending to become favorable to a preferential tariff.

A review of production indexes revealed that production was keeping ahead of population in the long run. A

spurt was evidenced after the relaxation at the beginning of the century which may account for the failure of the Conservative Party's protectionist program to arouse a more general interest. The worker's status at the end of the period was not perilous. As a consumer his interest lay definitely in free imports.

Finally, we have noted the self-acknowledged lethargy of British enterprise, and the failure to take full advantage of the opportunities created by the expansion of human wants. An unwillingness to sacrifice a large present income to the launching of new industries, seriously limited the diversity of her enterprise. It also dangerously concentrated the risks, weakening the fulcrum upon which a highly intensified industrial civilization rested. This aspect of the problem grows more acute when we recall that two of the great staple industries (coal and iron) were based upon resources whose exhaustion could be foreseen. Quite clearly, we are fully justified in asserting that economic forces were at work which might lead to the demand for a protectionist policy, and that these forces were ripening for a climax. The War stimulated the forces at work and hastened the climax.

## CHAPTER V

### POST-WAR INDUSTRY AND TRADE AND THE MOVEMENT TOWARD TARIFF PROTECTION

THE changes and shifts brought about by the unusual circumstances of the war period were felt mainly in the succeeding era of readjustment. The dependence of the British economic status upon world trade, with the latter greatly altered and at the point of exhaustion from the

long conflict, has conditioned her recovery. Obviously, the influences at work have been inextricably complex and ramifying. It is our purpose in this chapter to treat some of the underlying forces tending to mould the direction of Great Britain's recent economic evolution. Before undertaking



that, however, it will be necessary to give a general impression as to the nature of her trade and industrial conditions up through 1927. Because of the recent availability of abundant statistical indexes, it will be possible to make our analysis more descriptive of the whole situation. Our procedure, therefore, differs radically from that in the previous chapter. It is believed that such a treatment will make possible a clearer understanding of the post-war protectionist developments.

#### GREAT BRITAIN IN AN INDUSTRIAL DILEMMA

Upon release from war-time pursuits in 1918, British industry set about with astonishing vigor to fill the gaps and omissions created by her long military concentration. Her problem of reconstruction was different from that of her Continental Allies, because she had suffered no physical destruction. The task of readjusting and rehabilitating industry to peace-time occupation was the main one facing her. This was not to be accomplished with the ease one might expect, though the British themselves were deluded into thinking so as the world frantically set about replenishing its depleted stocks. Business men will recall the nature of the times. A seller's market existed, and for the British manufacturers this brought its worries. Raw material sources might easily fail. Hence, British aims were immediately to control sources of supplies, and to maintain as close relations as possible with the dominions in order to share adequately in those supplies under their control.

As a consequence, her whole commercial policy became imbued with an imperial spirit. The attitude she assumed at the Peace Conference, refusing to coöperate with France in the matter of raw materials, was full evi-

dence of this, in the opinion of the eminent French critic, M. André Siegfried.<sup>1</sup> The same critic asserts that it is revealed further by the British control over the export price of coal in the early period following the Armistice, and the 1919 grant of Imperial preference. Under no necessity to cultivate markets during this period of hectic international selling, the outlook of British leaders was distorted by the seemingly fundamental importance of securing raw materials. The primary need of realizing Great Britain's ultimate economic dependence on the export markets of the world was obscured temporarily in their minds.

Circumstances operated to prevent such a situation from remaining long the case. Much of Great Britain's exaggerated activity arose out of the artificial stimulation of continuous world-wide inflation. The inevitable bursting of the bubble brought the British and others to their economic senses. Industry and trade dropped rapidly into the deepest depression. Export trade melted away, and unemployment rose to unprecedented heights. The failure of Great Britain's Continental and overseas customers to absorb her products, and the difficulties encountered due to depreciating exchanges urgently demanded a reconsideration of policy.

Furthermore, Great Britain was having her own struggles with currency in restoring the gold standard according to the stringent recommendations of the Cunliffe Commission. The resulting disparity between external and internal prices unquestionably affected export trade.<sup>2</sup> Depression relentlessly persisted. Protective measures offered doubtful relief in the opinion of leaders

<sup>1</sup> Siegfried, *op. cit.*, pp. 19-24.

<sup>2</sup> *Ibid.*, pp. 29-43. See also, Keynes, J. M., *The Economic Consequences of Sterling Parity* (New York, Harcourt-Brace, 1925).



and the people. Hence, free trade doctrines, though mere shadows of their former selves, were invoked again as the commonly accepted standard of the British economic system. But they did not remain in the ascendancy long; continued dullness in all branches of trade and industrial activity occasioned further recourse to protective devices, the story of which our third chapter related.

#### INDEXES OF POST-WAR ECONOMIC CONDITIONS

A clear view of the extensive nature of Great Britain's depression is gained from tracing the general movement of business over the post-war period. Four indexes are available which are declared by authorities to illuminate her recent economic trend. They include an index of prices for twenty industrial stocks, the Board of Trade's index of material prices, an index of exports of British manufacturers, and a short money index.<sup>3</sup> All of the indexes are corrected for seasonal variation and are relative to the 1913 average. They have been plotted on Chart 6, which the reader should note carefully following our description.

We readily see that trade followed a steep upward course after the War, reaching a peak about the middle of 1920. This was a time of frenzied activity; all types of businesses and all forms of industry were under tremendous pressure to produce. Production figures for the iron and steel and shipbuilding industries were unusually high. Unemployment figures fell to a

lower level than at any period during the years from 1900 to 1914 (2.3 per cent in 1920 and 1.6 per cent in the first nine months of 1921). In addition, the per cent of pauperism was low. Prices, the cost of living and wages, on the other hand, rose to almost untold heights. The index of the cost of living, for example, reached a high point of 276 in October, 1920, and wages 277 in January, 1921. Beginning in the last quarter of 1920, there occurred a precipitate decline into the depths of depression, accentuated by the coal strike of 1921. There British trade and industry has remained to date.

The situation existing throughout 1922 appeared practically hopeless, in spite of a slight improvement toward the end of the year. Never in her long history had the United Kingdom been faced with a more critical trade crisis. The iron and steel industries did not recover, nor did engineering, cotton, woolens and worsteds. The distressing thing was that they did not reveal any signs of such a likelihood. Exports fell off; shipping was unprofitable; shipbuilding was at a standstill; and railway traffic in general merchandise, a fairly good index of domestic trade, was only 80 per cent of its 1913 figure and smaller still when compared with the boom year of 1920. Unemployment reached the astoundingly high level of 23.1 per cent in June, 1921, exclusive of coal miners on strike. Throughout 1922 it remained high, ranging from 14 to 17 per cent.<sup>4</sup>

#### A PERIOD OF FALTERING TRADE, 1923 TO 1927<sup>5</sup>

The year 1923 opened, as anticipated, with a degree of recovery and a new spirit of hopefulness. All indexes

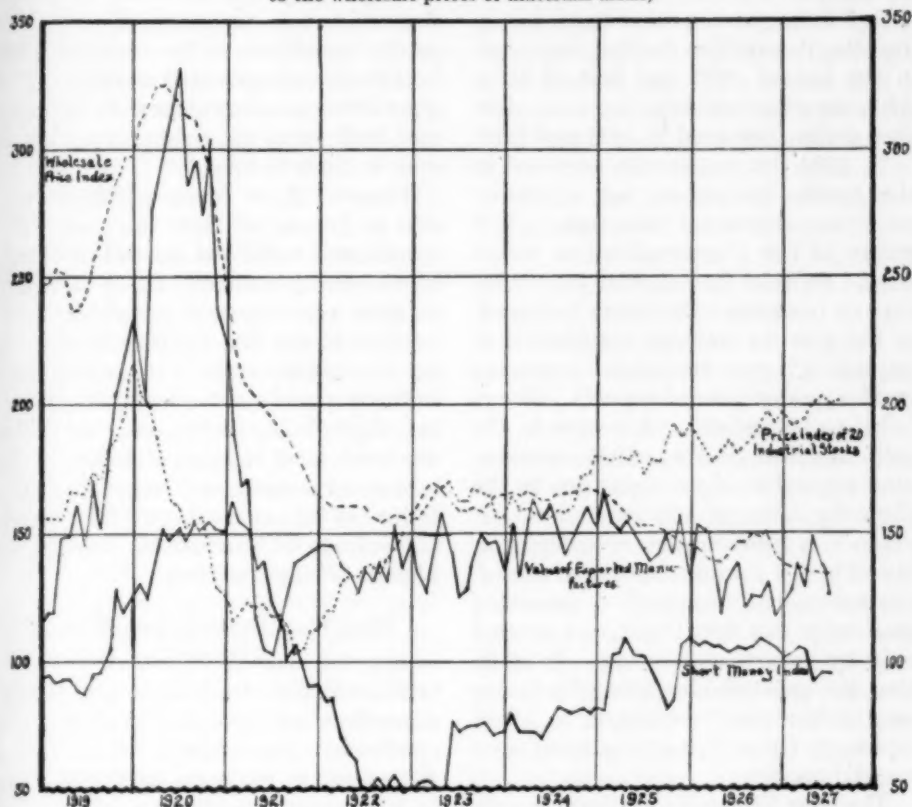
<sup>3</sup> Bowley, A. L. (and others), "An Index of British Economic Conditions, 1919-1922," *Review of Economic Statistics*, Vol. IV, p. 144, and the accompanying statistics, pp. 152-5. See also various letters of the *Harvard Economic Service*, 1923 to date. Chart 6 has been adapted from these sources. Prior to 1923, the Board of Trade index of wholesale prices, instead of material prices, is used.

<sup>4</sup> This index is said by some, however, to exaggerate the degree of depression.

<sup>5</sup> In this connection see the various letters of the *Harvard Economic Service* on British economic

CHART 6—SHOWING FOUR IMPORTANT INDEXES OF RECENT BRITISH ECONOMIC CONDITIONS, MONTHLY, 1919-27

(The data are relative to the year 1913 as the base. After 1923, the Wholesale Price Index is confined to the wholesale prices of materials alone)



encouragingly revealed healthy activity. Reaction followed in the second quarter, however, due to the failure of the export markets to absorb products as expected, the result of unsatisfactory conditions on the continent. In short, for the remainder of the year, the situation was about as follows: shipbuilding, the cotton and worsted industries were in deep depression; iron

conditions, from 1923 to date. See also the various indexes of British conditions published in the "Statistical Record," *Review of Economic Statistics*, Vols. VI, VII and VIII. These indexes, whose original source is the London and Cambridge Economic Service, are used as the basis of this analysis.

and steel exports were holding their own; imports were increasing; domestic trade, as shown by general merchandise railway traffic was holding up; and the unemployment situation was improved, although the percentage out of work was still over twice the figure which would have been alarming before the War.

Commodity prices which had remained relatively stable during the years 1922 and 1923 rose somewhat in 1924, falling again in 1925 and 1926, with a recovery in the latter months of this year, but a further fall in the first seven months of 1927. The general

level of money wages which had decreased in the first two of these years, rose again in 1924, remaining stable around 180 the next two years. The cost of living, on the other hand, faltering after its previous decline, rose again in the last of 1923 and first of 1924. After some fluctuation in that year, a further decline occurred in 1925 and 1926.

In 1924, improvements occurred in the textile industries, but otherwise conditions remained the same. The return of the Conservatives to power is said to have had a steadying influence on business. Optimism increased, as did also its material manifestation, imports of raw materials, presaging greater production and exports. Hopes failed to be realized. A return to the gold standard in May, 1925, accentuated a number of problems due to the disparity between import and export prices. A pronounced recession followed in the leading export industries; unemployment increased, a menacing coal strike was threatened, and averted only by government action. In addition, the unfavorable status of industry on the continent continued to affect adversely Great Britain's general commercial position.

The year 1926 was significant largely for labor conflict and declining industry. The failure of the Coal Commission's report to afford a practical basis for compromise led not only to a coal but a general strike. While the general strike lasted only a few days, the coal strike continued until the miners were forced back to work without a satisfactory settlement. Widespread industrial repercussions inevitably accompanied this strife. Production was curtailed in all major fields, intensifying an acute unemployment crisis. The value of exported manufactures fell to the lowest figure since 1921. This decline was most pronounced in such exporting industries as iron and

steel, textile machinery, china and earthenware, cotton yarn and piece goods. Moreover, the financial situation growing out of such a severe depression was extremely serious. Unsettled conditions in the overseas markets further complicated matters. The year 1926 came to a close with industry and trade in as dangerous a position as ever in their history.

Despite these facts, optimism was rife in December that the year 1927 would see a rapid and general recovery. As is seen by the 1927 curves on Chart 6, some recovery was in evidence, especially in the late spring months. A pronounced decrease in unemployment in the iron and steel industry, engineering, shipbuilding and commercial trades was evidenced in June, although in the coal areas it continued large due to the failure of export markets. The physical volume of production reached its highest level since 1920.

#### POST-WAR BRITISH AND WORLD TRADE

Since British trade is so completely dependent on overseas markets, the continued depression in the United Kingdom, as we have suggested, was in a measure a result of conditions beyond her control. Hence, certain questions arise; for example, what has been the general trend of world and British trade since the War? How do the present magnitudes compare with the magnitudes in the years just preceding the War? Is the share of Great Britain's trade an increasing or decreasing share in the aggregate trade of the world?

Replies to these questions cannot be made, of course, with close accuracy. Reliable approximate answers, nevertheless, may be advanced. League of Nations and British experts compute that in 1923, in terms of nominal gold value, the world's trade was 31 per cent

greater than in 1913,<sup>6</sup> 46 per cent in 1924 and 63 per cent in 1925.<sup>7</sup> Splitting this world trade percentage up into imports and exports, imports were in 1923, 30 per cent higher than in 1913, 44 per cent in 1924 and 62 per cent in 1925, while exports were 31, 48 and 64 per cent respectively. For the same period, plus the year 1926, the nominal gold value of British imports increased 45 per cent in 1923 over 1913, 56 per cent in 1924, 77 per cent in 1925 and 88 per cent in 1926. Exports, on the other hand, showed an increase over 1913 of 41, 38, 46 and 24 per cent respectively. When we consider these increases in British trade as percentages of the increases in world trade, interesting facts are revealed. British imports as a percentage of total world imports, to quote the precise League of Nations figures, increased from 16.48 per cent in 1913, to 17.89 per cent in 1924 and 17.79 per cent in 1925. British exports as a percentage of the total world exports, on the other hand, actually decreased from 13.93 per cent in 1913 to 13.01 per cent in 1924 and 12.43 per cent in 1925.<sup>8</sup> Naturally with the curtailment of British export trade in 1926, which we have noted previously, a further decrease in the percentage of British export world trade would appear.

It will be seen at once that little comfort can be derived by the British economist from a study of world trade figures. When it is recalled that, in the same period, world prices of commodities measured in nominal gold values were variously from 50 to 60 per cent higher than in 1913, the situation

becomes serious.<sup>9</sup> World trade, reduced in terms of 1913 prices, was in 1923 only 85 per cent of the 1913 figure, in 1924, 98 per cent and in 1925, 104 per cent.<sup>10</sup> Possibly if 1926 figures were available a further slight gain would be shown. This means that in actual volume of world trade there has been but a small gain and that only in the most recent years. It means further that the increased percentages of British and world trade in terms of gold value really conceals a diminution in the total volume of British trade. When adjusted to 1913 values we find that British imports were, in 1923, 86 per cent of their 1913 figure, 90 per cent in 1924, 106 per cent in 1925, and 127 per cent in 1926. British exports, on the other hand, were respectively 81, 77, 89 and 83 per cent of their 1913 volume.<sup>11</sup> Stated in terms of the League of Nations index of quantum of trade, British imports were in 1923, 93 per cent of their 1913 quantity, in 1924, 104 per cent and in 1925, 108 per cent, while exports for each of the respective years were 75 and 76 per cent in terms of 1913 quantities.<sup>12</sup> This shift in volume may be seen more clearly by the accompanying chart, Chart 7, adapted from the *Board of Trade Journal*, which shows imports and exports for 1925 and 1926 compared with the averages for 1909-13, the values throughout being adjusted by the Board of Trade index number on the base of the average prices of 1924.<sup>13</sup>

<sup>9</sup> Computed from League of Nations figures, *Ibid.*, p. 135.

<sup>10</sup> Committee on Industry and Trade, *op. cit.*, pp. 3-4.

<sup>11</sup> Adjusted prior to 1926 by the Federal Reserve Board indexes of British import and export prices and in 1926 by the Board of Trade all-commodity price index.

<sup>12</sup> League of Nations, *op. cit.*, p. 148. These figures contain approximate adjustments for the Irish Free State.

<sup>13</sup> "Imports and Exports in 1925 and 1926," *Board of Trade Journal*, Vol. CXVIII, pp. 94-5.

<sup>6</sup> The 1923 figures are from the Committee on Industry and Trade, *Survey of Overseas Markets*, p. 667.

<sup>7</sup> The 1924 and 1925 figures have been taken from the League of Nations, *Memorandum on the Balance of Payments and Foreign Trade Balances, 1911-25* (Geneva, 1926), pp. 131-5.

<sup>8</sup> *Ibid.*, pp. 132-3.



### THE DECLINE OF PURCHASING POWER IN OVERSEAS MARKETS

There are doubtless many reasons which may be assigned for the falling off of British trade in this post-war period. Our previous analysis has suggested some. Among the most pertinent of these is the decline of purchasing power in nearly all countries.<sup>14</sup> This has been due mainly to the general derangement of the economic mechanism of the world, and the widespread political alterations resulting from the Versailles Treaty. The influence of impaired consumption has been present in nearly every country in greater or less degree. Hence, its effects have been universal. Such an extensive decline of demand inevitably affected Great Britain, dependent as she is upon her export trade.

The decline of purchasing power has been perceptibly greater in the countries of central and eastern Europe, and in the near and far east, than elsewhere. Political conditions have dislocated the markets of India, China, and Russia, while others have been temporarily destitute because of financial disruption and a chaotic condition of currency and exchange. In addition, the mere fact of generally and rapidly declining prices has tended to discourage purchases for more than immediate needs. The general recovery of price and exchange stability in the last few years, of course, has tended to make this a less important element. Furthermore, it has been accompanied by some recovery in purchasing power, especially in central Europe. Nevertheless, on the whole, a curtailed purchasing power will doubtless characterize overseas markets for some time to come.

<sup>14</sup> Committee on Industry and Trade, *op. cit.*, p. 4

### THE GROWTH OF LOCAL MANU- FACTURE AND ITS EFFECT UPON BRITISH TRADE

A tendency always exists for the development of local manufacture to satisfy needs formerly supplied by imports.<sup>15</sup> Ordinarily, this process of substitution takes place slowly in a normal way and allows time for the necessary adjustments in the flow of trade. The World War had the effect of stimulating such development in many countries. Moreover, the War led to the establishment of industries which were essential to the demands of military activity. While many of these naturally vanished with demobilization, others continued to exist either through a natural capacity or some kind of protection obtained on the basis of national security, or general grounds of commercial policy.

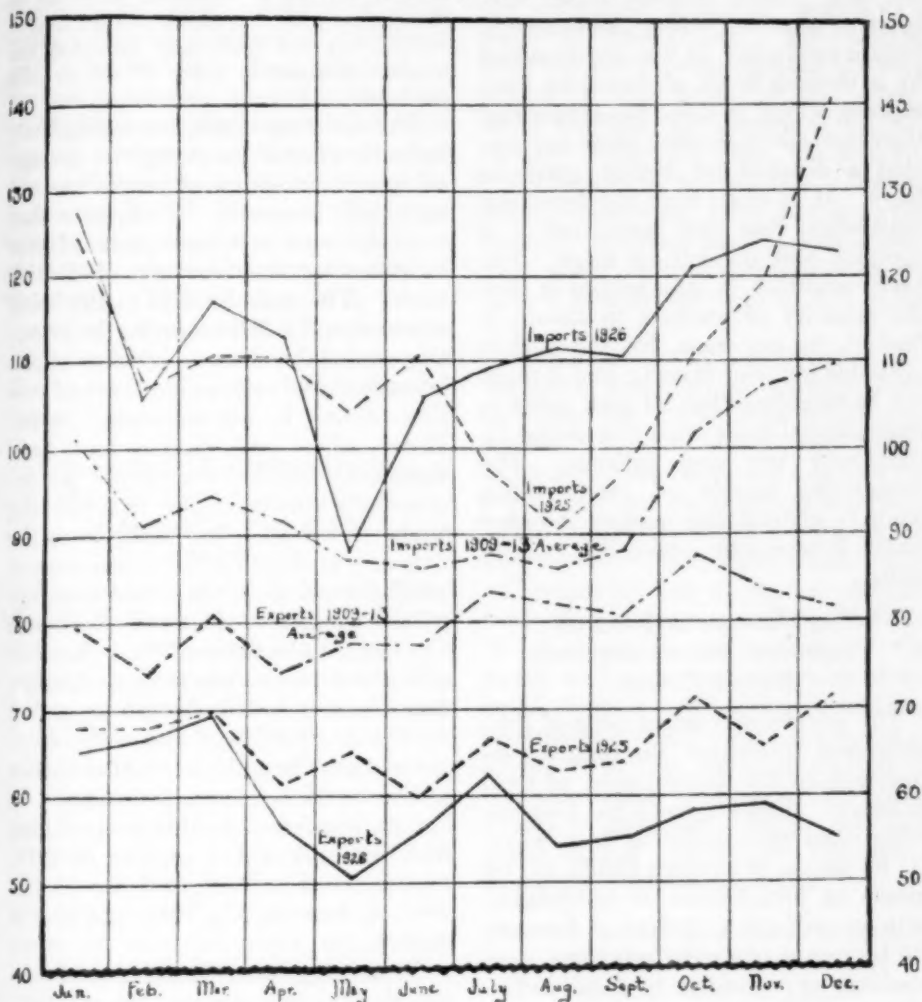
Among the principal markets in which local manufactures were growing up were Canada, Australia, India, Brazil, Argentina and Chile. The movement had been given an extra stimulus by the growth of intense nationalism and was fostered by various means of governmental action. This growth of local manufactures may have reached a state of overdevelopment, and will probably experience a contraction in the future; but for the time being, it has had a seriously restrictive effect upon established trade in general and British trade in particular.

The situation just escapes being hopeless from the British point of view, because of two offsetting considerations. The first is that new manufactures are largely concerned with simpler and coarser classes of goods, the field of international trade being left to engage itself in the manufacture of quality goods. There has been a tendency for British exports to consist

<sup>15</sup> Adapted from *ibid.*, pp. 9-13.

CHART 7—SHOWING BRITISH NET IMPORTS AND EXPORTS IN 1925 AND 1926 COMPARED WITH THE AVERAGES FOR 1909-13

(Values adjusted in accordance with 1924 average prices. Allowance has been made in the 1909-13 curves for the effects of the separation of the Irish Free State. This Chart has been adapted from the *Board of Trade Journal*)



more and more of quality goods. Thus, this movement in international trade may be beneficial to British industry because it operates to offset disadvantages in comparative costs. It also may mean that in the future the larger share of international trade will be captured by exporting countries "most capable of adapting their pro-

duction to special qualities of goods." Such adaptability was not clearly evidenced in British pre-war exports.<sup>16</sup>

The second compensation is more elusive but may be just as important in the long run. It is the fact that new industries create new wants for plant and materials, and also make additional

<sup>16</sup> See above, p. 74.

purchasing power for those whom they employ. For example, the increase of wealth in the United States accompanying its industrialization has given rise to a "luxury demand almost irrespective of price" which has benefited British products. It was accompanied by a slowing down of American food exports, which, in turn, has stimulated their increase from other areas and created a demand for British products there. It is clear from the foregoing illustration that this consideration is complex and difficult to trace. The basic condition in its analysis is that the capacity of markets to absorb is limited, in any case, by the outlets available for their exports; and it must not be forgotten that all such shifts in international trade are accompanied by temporary loss and suffering. The diminishing margin of profit which tends to characterize modern industry makes it especially susceptible to such shifts.

#### THE GROWTH OF FOREIGN COMMODITY PROTECTION AND BRITISH TRADE

The growth of various sorts of governmental protection has been a concomitant to the development of local industry. Such a growth has been accomplished principally in four ways: (1) by means of customs tariffs; (2) by means of prohibitions or restrictions, with or without a system of licenses; (3) by means of special privileges, concessions, or subsidies to local industries; and (4) by means of state control and monopoly.<sup>17</sup> Of these, tariff measures are easily the most important. The question arises as to the extent to which British trade has been limited by their growth from the period before the War. British authorities have made a study of the problem

<sup>17</sup> Adapted from the Committee on Industry and Trade, *op. cit.*, pp. 13-21.

(1924), and reached the conclusion that:<sup>18</sup>

... the average increase of tariffs on articles selected as representative, *i.e.*, the increase of charge expressed in terms of sterling per unit of product (not per unit of value), has not materially exceeded the average increase in value of the articles exported.

This is the same thing as saying that, up to the time of the study, the average *ad valorem* incidence of tariffs has not materially increased. It suggests that tariffs have not been an important factor in retarding the recovery of British trade. The same level of tariffs being retained and a fall occurring in prices, they inevitably have a greater effect, because the *ad valorem* incidence of specific duties is automatically raised. Hence, where price declines have been significant tariffs have played an increasingly important part in restricting trade. That such has really been the case may account for the prominence of tariff discussions in the recent meetings of the League of Nations' Economic Conference, the International Chamber of Commerce and the Inter-parliamentary Congress. It is further suggested by the distribution of British trade to ten of the principal protected countries whose tariffs were closely analyzed in the study referred to, this group taking 36.6 per cent of her exports in 1913, 37.2 per cent in 1923, 33.9 per cent in 1924, 34.9 per cent in 1925, and 29.8 in 1926.<sup>19</sup>

Concerning other forms of trade restriction for the purpose of protection, the use of prohibitions and restraints has been especially prevalent since the war. In some countries, particularly

<sup>18</sup> *Ibid.*, p. 14.

<sup>19</sup> This group included the United States, Germany, Argentina, France, Japan, Brazil, Belgium, Italy, Spain and Sweden. See *ibid.*, pp. 545 and 646-8. Also the various articles in the *Board of Trade Journal* on the annual distribution of British foreign trade.

those in central Europe, they have become a predominant feature. After some experience with these measures and their effects, there has appeared a tendency to reduce them to a minimum. Special concessions, privileges and subsidies have been granted to various industries, most important of which has been shipping. This action among foreign countries, the United States, for example, has been very injurious to British shipping. The shipping interests have also been the principal ones affected by state control or monopoly. The number of countries operating or controlling commercial shipping has increased to include the United States, Belgium, Roumania and Soviet Russia.

#### COMPETITION BETWEEN BRITISH EXPORTS AND THE EXPORTS OF OTHER COUNTRIES IN OVERSEAS MARKETS

An opinion commonly expressed by British trade leaders, especially during the period of the War, was that their exports into overseas markets were being widely displaced by imports from other sources.<sup>20</sup> This sentiment was, in part, a reflection of the intensity of competition immediately preceding the War. It was also in part an expression of fear concerning Britain's chances of regaining her foreign markets. Apparently, there was no evidence of such an event occurring.<sup>21</sup> Some competitors have improved their position or have retained it unimpaired; while others have suffered and are in a greatly weakened condition. Germany, for example, practically disappeared from the markets, and has had difficulty regaining her place, although she has made some strides in

that direction. Reparation payments may stimulate her recovery. France, on the other hand, has become an important industrial country because of the acquisition of mineral wealth as a result of the Treaty. The United States is also in a strong position with regard to the trade of the world; while Belgium, an important trading country before the War, has not entirely recovered her position. Among other competitors, Italy has acquired strength in certain textiles, and Japan, also strong in textile production, retains a formidable place in still other lines.

Prominent among the influences aiding some countries to improve their situation has been depreciated currencies. Another which has handicapped certain countries in their recovery has been the shortage of capital. These factors appear to be of a transitory nature but may have effects which will persist far into the future. British trade does not seem to have suffered ill treatment in the markets of the world, and, in general, stands on about equal footing with other countries. She enjoys distinct tariff advantages in trade with the dominions, and a real advantage accrues to her from France's minimum tariff schedule which is not enjoyed by any other important commercial nation.

#### THE GROWTH OF BRITISH PREFERENCE AMONG THE DOMINIONS AND ITS VALUE TO BRITISH TRADE

It will be recalled that nearly all the self-governing dominions, except Newfoundland, granted preference prior to the War. After the War, the same group continued—indeed, increased—their preference grants. For example, in 1914, the preference granted by the dominions was on the average higher than their general tariffs by about 4 per cent *ad valorem*. By 1925, this

<sup>20</sup> See, for example, Hewins, *op. cit.*, Chapter IX.

<sup>21</sup> Adapted from the Committee on Industry and Trade, *op. cit.*, pp. 21-3.



preferential advantage had been increased to 9 per cent *ad valorem*.<sup>22</sup> The increases, *ad valorem*, for the various dominions, have been as follows: 8 per cent in the case of Australia; 8½ per cent in the case of New Zealand; 2½ per cent in the case of Canada; while the level of preference in South Africa has remained relatively unchanged, although she has removed preferences in lines where Great Britain has led the competitive field. With regard to India, no preference could be granted by her before the War because of the dominating influence of the British in her governmental administration. During the War her government was reorganized, leaving her with a large degree of fiscal independence. Since that time she has taken several protectionist measures and embodied them in tariff enactments. It is the hope of many of the British that India will shortly arrange to grant such preferences as are consistent with her tariff policy.<sup>23</sup>

It is extremely difficult to obtain any measure of the benefit of preference to British trade. The influence of coöperative effort to execute the War effected closer economic relations in the Empire and should certainly be stressed. All effort was made at that time to divert the greatest possible proportion of colonial and dominion exports of food and raw materials into the United Kingdom. In some cases, official purchases by the British Government were of paramount importance in directing this flow. The British themselves are quite convinced that a beneficial effect has accrued

<sup>22</sup> Committee on Industry and Trade, *op. cit.*, p. 24. In addition, preferences are now granted by a number of dependent colonies, ranging from 3% to 25% *ad valorem*. See pp. 551-3.

<sup>23</sup> Williams, L. F. R., *India in 1924-25* (Govmt. of India Central Pub. Branch, Calcutta, 1925), pp. 166-73.

from preference. One statement from an authoritative source has even asserted that there is left "no room for doubt that the advantage has been substantial."<sup>24</sup>

In confirmation of this, the percentage of British exports taken by various parts of the Empire rose as follows from the annual average for the ten-year period from 1904 to 1913.<sup>25</sup>

	<i>Per Cent</i>
Annual average, 1904-13.....	34.8
1922.....	37.5
1923.....	37.2
1924.....	38.5
1925.....	39.2
1926.....	44.8
1927 (first quarter).....	43.02

This increase in exports to the Empire has been largest with the dominions, and especially with Australia, which received 9.9 per cent of the total British exports in 1926 and the first quarter of 1927. A slight increase also occurred in the percentage of exports to New Zealand and South Africa, but not to Canada. Exports to other possessions increased slightly from 6.3 per cent in 1913 to 8 per cent in 1925, 8.6 per cent in 1926 and 9 per cent for the first quarter of 1927. Those to India, on the other hand, fell off slightly from 13.4 per cent in 1913 to 11.8 per cent in 1925, recovering to 13.3 per cent in 1926 and 12.3 per cent for the first quarter of 1927.

Imports from the dominions and possessions also increased, being 24.9 per cent in 1913, 27 per cent in 1924, 29.6 per cent in 1925, 27.3 per cent

<sup>24</sup> Committee on Industry and Trade, *op. cit.*, p. 24.

<sup>25</sup> These figures exclude exports to the Irish Free State. See articles on the distribution of trade published in various issues of the *Board of Trade Journal*. In this connection, it should be recalled that the actual volume of British export trade in the post-war years has been very much lower than the 1913 volume. See above, pp. 83-4.

in 1926 and 26.8 per cent in the first quarter of 1927. No outstanding shift in the percentage taken from any single dominion is observable, although most of the increase is accounted for by the imports from Canada, Australia and New Zealand. From India, imports like exports have decreased from 6.3 per cent in 1913 to 4.8 per cent in 1926 and 5.04 per cent for the first quarter of 1927. This growth in trade with Empire markets, coincident with the growth in preferential allowances, is the basis for the conclusion regarding the benefits of preference, a conclusion which must be carefully qualified.<sup>26</sup>

Further qualification is needed, too, when we consider the extent to which the United Kingdom shares in the total imports and exports of the self-governing colonies.<sup>27</sup> In every case, from 1913 to 1925, there has been a decrease ranging from 4 to 8 per cent in the percentage of imports received from the United Kingdom. Save in the case of New Zealand, there has likewise been a decrease in the percentage of dominion exports sent to the mother country, amounting in the case of South Africa to 32.5 per cent. It must not be forgotten, however, that the volume of trade carried on by each self-governing colony with the United Kingdom remains a significant proportion of their

total trade. Doubtless, rather than admit the failure of preference to benefit them, the dominions would contend its application had been insufficiently extensive. It is from the point of view of Great Britain, however, that a justification of post-war preference must be sought. Certainly the admission of the importance of preference by the Committee on Industry and Trade lends the weight of official sanction to the protectionist argument that the policy of free imports no longer meets the exigencies of British trade.

#### SUMMARY

Having described generally the depression obtaining in British industry and trade up to the present time, we have seen on close analysis that the post-war period has witnessed a very considerable shrinkage in her trade volume.<sup>28</sup> Four underlying influences which have been assigned special importance in causing this shrinkage were reviewed carefully: first, the decline of purchasing power in overseas markets; second, the growth of local manufactures; third, the growth of foreign commodity protection; and fourth, the state of competition in the export markets. Finally, we noted the growth of preference among the colonies and the statement of the Committee on Industry and Trade concerning the value of preference, and examined the available trade data which might support such a view. Considerable

<sup>26</sup> Professor Henry Clay points out, in this connection, that the real explanation of increased exports to Australia and New Zealand lies in the recent outburst of prosperity in these dominions, and also in the fact that these markets have been the recipients of large loans from London since the War. Professor Clay believes that there can be no effective preferential scheme without a general system of protection, which does not suit the needs of the English economic system. See his article, "Imperial Economic Relations," *Manchester Guardian Commercial*, Vol. XIII, pp. 445-6.

<sup>27</sup> The figures which have been used in this connection are found in the League of Nations, *op. cit.*, pp. 158-61.

<sup>28</sup> A very good brief presentation of the economic problems confronting Great Britain at the present time is contained in a statement submitted to the recent International Economic Conference (Geneva, May, 1927) by the British members of the Conference. See the documents of the Conference, League of Nations, *Principal Features and Problems of the World Economic Position from the Point of View of the Different Countries*, C. E. I. 29, 1st series (Geneva, 1927), pp. 18-25.

qualification appeared to be necessary. Before concluding finally upon Great Britain's post-war industry and trade and the movement toward protection,

let us regard it in relation to our previous development, passing such judgments as seem warranted in the light of our entire treatment.

## CHAPTER VI

### CONCLUSION

THAT a pronounced trend toward tariff protectionism has occurred in Great Britain in recent years has been evidenced in the historical facts here assembled. Its embryonic origins, both political and economic, have been seen to lie many years in the past. We may fairly wonder where the ultimate end may be. Is a return to *simon pure* free trade, for example, within the realm of possibilities? If not, will Great Britain, when faced with the international consequences of a protective system, hold out to the world as a protagonist of free trade, while within the Empire, advancing and extending a program of preferential protection?<sup>1</sup> Have international trade conditions so altered as to warrant the overthrow of the traditional free trade principles as the basis of her tariff system? Is it at all probable that Great Britain might erect a general protective system? Would such a change be desirable from the standpoint of her own self-interest?

These and countless other questions have doubtless arisen in the mind of the reader. No complete answer can be made to them, but we may appreciate the significance of current trends in the light of the facts which have been related. The policy of free trade, when adopted, unquestionably was an important factor in enabling Great Britain to gain an enormous advantage in world trade, other factors, of course, con-

tributing. Propitious circumstances, in other words, during the period from 1851 to 1901, permitted an extraordinary development of industry, trade and commerce.

Rising standards of living were witnessed on every side. Population, confirming the Malthusian conclusions, rose from 27.4 millions in 1851 to 41.5 millions in 1901, an increase of 51 per cent, tending to fill the gaps opened by rising standards. The importance of this is appreciated more thoroughly when we recall the limited area of the British Isles. In other words, the increased concentration of population which accompanied Great Britain's economic expansion, meant a highly compact industrial civilization largely dependent upon foreign sources of supply for its principal foods and raw materials. The maintenance of existing standards, or slightly rising standards of living, for such an increasing population, thus was dependent upon the growth of trade at an equal or a slightly faster rate. On the other hand, anything which might interfere with or interrupt the required circular flow and growth of commerce would be attended with disastrous consequences.

The last century saw this development go on almost unhindered up to 1873, with a slowing down after that year. The continuity of its increase was maintained, however, through the fourteen years following 1900. Population growth continued to persevere, likewise, increasing 9 per cent more

<sup>1</sup> M. André Siegfried suggests this. See his book, *op. cit.*, p. 29.

from 1901 to 1911. In 1914, the dreaded interruption occurred, despite which population increased 4 per cent more before 1921. What has happened since, the far-reaching nature of British depression with its extended unemployment, has been reviewed. Hardship and distress have prevailed necessarily among many classes. Although the average level of "real" wages for full time work was not substantially different in 1925 from the pre-war level, if allowance is made for the widespread unemployment and short time employment prevailing in many industries, the average level of "real" weekly earnings has been much lower than it was immediately before the War.<sup>2</sup> Reduced incomes in many groups, therefore, have resulted in a measurable lowering of their standards of living.

The situation, in view of the population figures, is tense. Britain, in consequence of the pressure she must feel, is obliged to do all in her power to maintain the operation of the economic system which she has built up. Things must be kept running at all costs. It is no wonder, perhaps, that her leaders have been tempted to grasp at the alternative of protection when the machine has failed to operate smoothly under free trade. Doubtless, no government could be expected to hold to the broad and enlightened reasoning of orthodox economic teaching in circumstances rife with dangers. The British leaders are forced to witness the pressure of world forces on the means of national subsistence now as never before. In short, to the political party in power charged with the responsibility of trade recovery (especially if it be already possessed of protectionist inclinations), the straight and narrow path of free trade has become a thorny

road; while the various ways of protection have appeared as the paths of possible solution.

Returning to our story of free trade and protection, let us regard some of the important facts relating to the origin of the former. Historically, authorities generally agree that its adoption arose from the practical pressure of self-interest among the manufacturing classes, whose conviction of its efficacy constituted the chief basis of its support. The outburst of prosperity and the growth of trade following the application of a free import fiscal policy led to its general acceptance by the popular mind. Any question of its merits thus became superfluous. As a national policy, it acquired a traditional and sentimental aspect which tended to become ingrained as a strong popular bias.

With the first great depression (1868), there appeared to be some question of the soundness of the policy. The growth of tariff barriers abroad obstructed some of the most important outlets for British products; and the development of an industrial technique behind them increased competition. Such barriers and accompanying competition were not only becoming common with foreign countries, but increasingly frequent in the self-governing colonies. More than that, the periodic recurrence of depression in the three decades following this date stimulated an "off and on" protectionist agitation, keeping the issue thoroughly alive.

In the last fifteen years of the nineteenth century, there occurred the first meetings of colonial and British representatives in conference, bringing with them the initial suggestions of an Imperial tariff system, based on the principle of reciprocal preferential treatment. Coincident with these Colonial Conferences was the growth of a new

<sup>2</sup> Committee on Industry and Trade, *Survey of Industrial Relations*, 1926, pp. 96-8.



popular interest in the Empire, and the turn of the century was marked by the awakening of colonial concern.

The idea of an Imperial tariff system, based upon the principle of preference, expanded into a movement of large proportions, and made propitious such a campaign as was carried on by Mr. Joseph Chamberlain from 1902 to 1906. Among the events of practical significance which aroused much thoughtful consideration of the problem at that period were: (1) the increasing difficulty of surmounting foreign tariff barriers, the expansion of competition, and the frequency of trade depressions, which we pointed out above; (2) the willingness and desire of the self-governing colonies, as expressed at the Colonial Conferences of 1887, 1894 and 1897, to participate with the mother country in a comprehensive preferential system; (3) the actual granting of preference by the Canadian Government to the products of the United Kingdom in 1897; and (4) the receipt of definite proposals from the various dominion governments at the 1902 Conference.

The policy of free imports, however, was too deep-rooted in British state and popular tradition to be altered so readily. Furthermore, trade had been good from 1898, save for a slight reaction in 1903 and 1904. A protective tariff or any extension of customs duties for preference purposes, therefore, held little allurements for business interests and was even more distasteful to the consuming classes. The really important result of the Chamberlain campaign was that it committed the Conservative Party to the idea of a tariff for protection, although temporarily at the price of office.

From 1906 to 1914 the dominions continued to bring pressure to induce at least a change by a preference grant on existing duties. But the British Government, under Liberal leadership,

adhered closely to the policy of free imports. Pressure was manifest especially in the two Imperial Conferences of 1907 and 1911. It was also brought into practical prominence by the preference grants of the various dominions in accordance with their proposals of 1902.

In a subsequent chapter, after examining the changing distribution of British trade during the period from 1900 to 1914, we noted the growing importance of the self-governing colonies and other possessions as sources of food supply, and their continued value as sources of raw materials. Moreover, as export markets they possessed considerable importance. Hence, there is reason to believe that this colonial pressure eventually might have forced the preferential principle into the British tariff, without the stimulation given to the movement by the War.

That the foregoing belief would have materialized, of course, cannot be more than asserted. The declaration of war certainly brought in its train a succession of extraordinary conditions. For example, the fact that British industry found itself without certain vital and essential commodities, whose production had been controlled by enemy interests, exerted a profound influence. It was, in fact, fundamental in causing the enactment of legislation safeguarding "key" industries soon after the close of the war, and its permanent continuance, at least as far as one can reasonably foresee, in the British tariff. With the growing intensity of popular war feeling, there came to prevail a general fear of the economic designs of the enemy countries, and a widespread delusion concerning their preparations for post-war economic conflict. The Paris Resolutions and their acceptance by a Coalition Government, in which the Liberal (free trade)

Party predominated, illustrates the importance of this force and the foregoing one.

Among other important factors, there was the opinion generally held that Great Britain would have to meet unusual competition in regaining old world markets and in securing new ones in the post-war period. The various reports of the Lord Balfour of Burleigh Committee suggest the extent to which this force was effective in influencing public opinion. The response of the dominions in supporting Great Britain in her war program is also important for us to recall at this time, because it made such an undeniably deep impression upon the British mind. The unanimous approval given the preference principle by the 1917 Imperial War Conference, and the subsequent expression in the British preference grant of the 1919 Budget, unquestionably were made possible by the war stimulus to Imperial sentiment.

The enactment of the McKenna duties was the first step taken in utilizing the British tariff for protection during the War. The continuation of these duties in the period following the War was made possible by the momentum initiated by the above-named forces. In other words, British statesmen and business men had come to look upon the idea of tariff protection first with tolerance and then with sympathy, themselves scarcely recognizing the many subtle forces that were at work changing their attitude.

In the post-war period, the paramount influence at work in promoting the spirit of protectionism has been the unprecedented depression in British trade and industry described in the preceding chapter. The necessity of keeping the machine going at any cost, as we emphasized earlier, has led to a grasping at every possible expedient. Mr. Baldwin's justification of his

general protective proposals, when he appealed to the country in 1923, is illustrative of this. The same sort of pressure has been evident in the more recent application of the new safeguarding policy; namely, that of maintaining those industries suffering from extraordinary competition at the expense of industry as a whole. The tremendous problems which have faced the United Kingdom as a dependent manufacturing nation with a highly localized industrial population, have effected a willingness to accept a reconsideration of the tariff issue.

The post-war problems, of course, have arisen from a number of sources. Among the most important are the decline of purchasing power in overseas markets; the growth of local manufactures; and the growth of foreign commodity protection. These are complicated by the obligation to America which Great Britain has agreed to pay, and by the payment of German reparations to the Allied Powers. Certainly, a combination of such elements would seem to place the United Kingdom in a defensive position commercially, and would tend to establish a state of mind conducive to the application of all manner of protective measures.

The British preference advances of the 1923 Imperial Economic Conference and their subsequent adoption in 1925, are of considerable significance. British trade with the colonies and dominions increased from 1913 to 1926, it was pointed out, far more than it increased with other countries (although this was an increased percentage of a greatly diminished total volume). Europe, however, Britain's other large customer, was suffering from an extended depression, complicated by high tariff barriers. In addition, trade with the United States had experienced little increase over

1913. In the same period, on the other hand, there was a general increase in the average rate of preference granted by the self-governing dominions. With rising tariff barriers abroad, the experience of a war shortly past in which the colonies rendered invaluable assistance, and growing trade with the colonies, it would seem that additional developments along the line of preference would be likely. The 1926 Finance Bill, guaranteeing as it does all existing preferences for a period of ten years and the further extensions of the 1927 Budget are in confirmation of this.

The broad fact remains that Great Britain has become a protectionist nation with regard to her tariff.<sup>3</sup> Of course, a retreat to a complete free import policy is not outside the realm of possibilities. Yet, when we consider the extent to which tariff protectionism

has been carried, and thoughtfully weigh the conditions of British and world trade, it does not seem likely that such will occur, at least in the immediate future. On the contrary, we may expect, excepting an unlooked-for trade revival, that further use of the tariff for protection will take place. Probably, it will be along lines already established; namely, safeguarding and preference. The longer the process is continued, and the deeper rooted and institutionalized the system becomes, the more concerned the vested interests will be in its maintenance, and the greater its chance of extension and permanence.

That Great Britain will become protectionist in the manipulation of her tariff to the extreme extent that some other nations, as the United States, have become protectionist, it would be beyond all reason to assert. What is evidenced by our survey of the facts is that the United Kingdom has become involved with regard to her tariff in a type of protectionism which has supplanted, to all intents and purposes, her traditional policy of customs duties for revenue only.

<sup>3</sup> Despite the fact that a recent British official statement asserts that the whole of the goods liable to the "new" duties only amount to 2% or 3% of imports. See the League of Nations (International Economic Conference), *Principal Features and Problems of the World Economic Position from the Point of View of the Different Countries*, op. cit., p. 25.

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